American Machinist

Volume 65 New York, August 26, 1926 Number 9

Bringing Production Methods to the Job Shop

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IN THESE days of large production records, and mammoth plants erected to the glory of production, one is apt to forget that after all the majority of our industrial establishments are more or less small shops of a jobbing nature. The work carried on in such shops is of an extremely varied nature. Some are jobbing foundries, others are jobbing forge shops, still more are general machine shops. They are not actuated with any single purpose unless it be to make money, but all have their mythical shelves filled with a variety of goods which the customer may select as he pleases. If a customer wants a small bar turned up, 1 in. in diameter by 12 in. long, such a shop will accommodate him. If he wants a complex piece of machinery made up as a sample, the same shop is there to oblige. The attitude of the job shop reminds one of the couplet:

"Who is the man who'll draw a plan for anything you desire
From a transatlantic liner to a hairpin bent of wire?"

And here lies the big difference between the job shop and the production shop. The production shop very distinctly knows what it is going to make, but the jobbing shop just as distanctly does not. For this reason many jobbing shops figuratively throw up the sponge and ask what is the good of putting system and method in their shops when there is none in their orders. Also for this reason when they are asked to make quotations they furnish a range of bids that, when analyzed, make the production cost accountant wonder how on earth they can do it and get away with it. A production staff is used to the problem of making the production cost balance more or less accurately with sales figures set months previously; that is its job. If the sales department determines that there is a market for their product at a certain price, then it is up to the factory to make a product which will meet that price. And the marvelous thing is that they do it.

In a big shop the industrial engineer works in cooperation with the purchasing agent in scheduling material so that it comes in when wanted, as wanted, and not months before the time. For example, it might be possible to order all the material for the year to come in at one time, but such a procedure would involve a tremendous expenditure of capital not only for material but also for the building of storage space. The closer, therefore, material can be brought in prior to the date that it is required in the shops, the less the capital expenditure is, and the less the storage space. This point is just as essential for the job shop as for the production shop. It should, therefore, be someone's duty in the job shop not merely to order material but to order it to come in at definite dates. "Soon as possible" is a very convenient phrase, but it is an expensive one at times and can well be replaced by something more definite. Too many job shops do not realize the important bearing material scheduling, as it is called, has on capital, and it would be wise for them to consider how much money is locked up in idle material—money that might profitably be used elsewhere.

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While on this question of purchasing, let us take up another aspect. Production shops find it advisable to indulge in accurate specifications in order to get the material they want. How many job shops, for example, realize that there are 100 different varieties of steel, each definitely labeled with a specification, and that the extremes differ by an amount greater than the difference between low-carbon steel and red brass? Alloy steel is not simply alloy steel—it is either chrome-vanadium, chrome-nickel, chrome-molybdenum, chrome-tungsten, silicon-manganese, silicon-vanadium and so on in varying proportions. Each steel has its own particular quality which suits it for specific purposes. Similarly through all the ranges of brasses and bronzes. There are definite specifications which industrial engineers have worked out to simplify purchasing—not to confuse it.

One production shop, The Packard Motor Car Co., not only specifies the chemical constituents of its steels, but also stipulates the physical factors and further adds

a microphotographic specification. This is surely carrying specifications to a very precise degree.

Oil and coal are bad subjects from a purchasing point of view. Does the plant always know what it is going to get when oil is specified? Similarly with coal? How many job shops specify the B.t.u. content of the coal that they buy? And yet the big production shops find they get "coal," not slate, when they order it in such manner. Otherwise the purchaser gets what the supplier wants him to get. You may state, of course, that the honesty and integrity of the supplier is your best guarantee, and it is to a large extent, but in the case of ordering steel as such, if *you* don't know what you want, how is the supplier to know?

Now let us turn to the question of shop arrangement. The big production shops have found it tremendously profitable to have an industrial engineer study their layout so as to get material flowing in as even a direction as possible. One very vital factor that these production shops discovered was that the time wasted at machines was small compared with the time wasted in handling the job between machines. When a job is on the machine it is being operated on by a more or less intelligent man, and the foreman is there to supervise the work and to see that there is little idleness. But who supervises the work when it is taken off the machine and laid on the floor? Usually it is nobody's duty, and the work lies there until the next man wants it, and there is often a period of time between his want and the supplying of it. The machinist often has to go for the material, leaving idle a profit-earning machine.

Machines Placed Where Needed

Another thing that is very common in job shops is that material is carried considerable distances, backwards and forwards, crossing and recrossing its own paths. This is caused by the fact that machines are segregated according to their type. In the production shop the tendency, today, is all in favor of placing the machines in the order of their use. This tendency is even carried to the extent of placing heat-treatment furnaces immediateley between the milling machines, the lathes, and the grinding machines so as to get uninterrupted flow of material with minimum handling.

This procedure cannot be adopted in the job shops, as I believe it is better to segregate machines therein in accordance with their type. However, a study of the usual work flowing through will show that there are very often jobs which, for example, have drilling operations either before or after lathe or milling operations, and which occur frequently enough to make it desirable to put a drill press or two in the lathe and milling machine department. This simple plan will often save a lot of handling. Much can be done by arranging the different units in terms of flow of work.

It is obvious, of course, that the receiving platform should be alongside the railroad spur. It is just as obvious that the raw material stores should be combined with the receiving department. Now, if the next usual operation is a turning one, the lathes should be placed near to the stores, the drill presses near to the lathes, the milling or planing and shaping machines next, and so on in the proper sequence of the usual travel of work. Finally, the work should flow so that the assembly department is alongside the shipping room, which should be next to the receiving room so that full advantage may be taken of the fact that the railroad spur is conveniently located alongside the plant.

The job shop, just as the production shop, should never lose sight of the fact that material means money and that greater material turnover means more money. Some years ago I was greatly troubled with the indifference that workmen and even foremen paid to material. Material to them had little significance and was merely a convenience for getting a job done. After studying the matter for some time I finally thought that a little lecture, accompanied by an object lesson, might help. So one noon-hour as I passed by the place where the foremen often congregated to discuss politics and "chew the rag" generally, I pulled my handkerchief out of my pocket and with it came a dollar bill, which fluttered to the ground. Practically every man made a jump to retrieve that bill and to return it to me, whereupon, I stopped and told them that they would jump at a dollar in the shape of money, but that five dollars worth of material lying around would leave them unmoved. I told them that material was an intermediate stage between two money transactions—the money you paid out and the money you took in—and that idle material was just so much idle money absorbing capital that could be devoted to more profitable investments. The lesson had its effect and, as a result of it and some further conferences, I had the pleasure of seeing a drop in the scrap percentage and an increase in the material turnover.

Material turnover has become tremendously importance to the production shop; it should be just as important to the job shop. Material turnover is the number of times that capital, devoted to the purchase of raw materials, is turned over in a year. For example, if you purchase raw material at the beginning of the month, and fabricate it, assemble it and ship it by the end of the month the material turnover is twelve times. Some shops, like shipyards, have a small material turnover. Other establishments, like brick making firms, may have a turnover as large as twenty-four times. A few automobile manufacturing plants have a turnover of twelve to eighteen in a year. However, the big point is that no matter what your turnover may be, it can usually be improved by a study of conditions. Material turnover is one of the biggest factors in determining the efficiency of a shop.

While on the subject of materials, the subject of standardization and simplification should be considered. A visit to a pattern-storage department will show many examples of lack of standardization. There are usually patterns so much alike that the differences are practically unrecognizable. There are patterns for right-hand and for left-hand pieces that with a small amount of ingenuity could be made to serve both purposes. Now each one of these patterns represents not only the time of the pattern maker, but also the time of a draftsman. Surely a little effort, and some attention paid to what was already in existence, would have obviated this near duplication and would have saved money for the shop. Standardization and simplification are tremendously big subjects. They lead to savings in the drafting room, in the foundry, in the machine shop (where it is unnecessary to make up new tools) and finally in the selling department and they lead to greater savings when the material is sold and the work has to be maintained. Interchangeability can be attained only by standardization, and, if spare parts have to be kept in stock for products furnished, it leads to a saving in the

number of parts covered. Standardization and simplification can well be studied by the job shop and used as an effective tool.

Similarly, the work going through the job shop could be studied. Often it will be found that one job repeats itself constantly; if so, study this job. Study its possibilities, its additional markets, if any; study whether it is cheaper to fabricate the whole quantity at one time or at various times throughout the year; study whether it will pay to make a change, even a temporary one, in your layout so as to make it cheaper. The production shop does not hesitate, when occasion demands, to change the layout of a shop over the weekend in order to save a fraction of a cent per piece. Similarly there should be some degree of flexibility in the job shop so that, if advisable, the shop could be changed around a bit to effect a saving which would be more than the cost of the change. That factor, of course, is the important point. No changes should be made unless savings can be seen, and in order to insure savings you must have an accurate cost-accounting system. This may and can be simple, but must be accurate. Cost accounting is not an end, but is a means to an end, and can be used in the job shop as an efficient tool to aid the management in its plans.

Too many job shops find the effort of making time studies of work too much for them, and they abandon the idea and continue paying their men day rates without incentive. There are two drawbacks to this system. First, the job shops don't get the best men, and secondly, they don't always make money on the job because of the uncertainty of the labor price.

Now, it is quite possible to make a study of certain operations, to put labor prices on them, and to establish the men on a more or less piece-work or premium basis. One of the greatest examples of this can be found in the automotive repair shops. During the last two or three years, what is known as the flat-rate schedule system has swept the country. It is now possible, when you have trouble with your car, to take it to a garage and get a guaranty that the labor price will not exceed a definite amount.

This advance was accomplished by making studies first as to the best means of doing the job, and secondly, as to the time of doing it. These operations were then standardized, and prices were set on them for the customer. In addition, after deduction has been made for overhead, etc., a price was set for the workman who thus knew exactly how much time he had in which to do the job. Soldiering was abolished, more work from fewer men was attained, and a complete tonic was given to the repair shops of the automotive industry. Surely, if it can be done in the case of such shops, it can be done in the case of jobbing shops whose sole business it is to fabricate material, and whose intelligence is usually of a higher order than that which prevails in an automobile repair shop.

Job shops, as I have stated, comprise a large percentage of our total industrial establishments, and I firmly believe that modern methods can find a place in them.

Right of Recovery for Repairs

By Leslie Childs

WERE machinery is purchased under a contract that expressly warrants, or guarantees, its fitness, the seller is bound to furnish goods that meet the specifications, and if the machinery does not comply with the warranty, the buyer may rescind the contract, sue for damages, or take such action as the facts will support. However, where machinery sold under a warranty does not comply with the contract, the seller is entitled to have notice of such fact, and be given an opportunity to make repairs. If the buyer fails to give notice of defects, and makes changes on his own account, he may be denied the right of recovery for such repairs from the seller who guarantees the machines.

The application of this point of law is illustrated in a number of cases, involving repairs made to machinery purchased under a warranty contract, and, as an example of judicial reasoning on the question, the Kentucky case of Black Diamond Coal Company vs. Heyl & Patterson, may be reviewed with profit.

In this case, the mining company entered into a contract for the purchase of machinery to be used in its plant. This equipment was warranted by the sellers for workmanship, material, and capacity to perform the work intended. The sellers installed the machinery, and it gave evidence of being satisfactory. The mining company accepted the equipment in writing, and stated that if any trouble in operating developed it would make a report of same to the sellers.

About a month later a motor began giving trouble. The mining company, however, did not notify the sellers of this fact, but had the motor repaired by other parties at a cost of $425.40. A dispute then arose over the payment of the balance due upon the machinery, and the sellers filed action to enforce payment. The mining company entered its expense in repairing the machinery, and contended that it should be allowed this sum on the purchase price of the machinery.

The lower court gave a judgment in favor of the sellers of the machinery, but the mining company appealed, and raised the question of its right to recover for the amount it had spent in repairs. The higher court, however, confirmed the previous judgment in the case. The gist of the court's decision is here given.

"It will be recalled that the buyer wrote that it would report if there was any trouble in the operation of the machinery. Instead of doing this, it undertook to have the same repaired by other persons, without notifying the seller.

"Where there is an express warranty in the sale of machinery with an agreement to notify the vendor of any breach, and no notice is given, no recovery can be had on such breach of the warranty. The vendor, who is liable on his warranty, is entitled to notice of the breach so that he may himself, in his own way and at the least possible expense, repair the machinery and relieve himself from liability on his warranty."

In conclusion, the court rendered judgment in favor of the sellers of the machinery, holding that since the mining company made the repairs without giving notice of the defects it was in no position to claim credit on the bill for the amount expended. In other words, if a buyer goes outside of the contract, and incurs expense in such a matter, he will not be permitted to charge the seller's account with the amount so spent.

Old Man Johnson and the Army Inspector

By John R. Godfrey

OLD MAN JOHNSON has been having a seance with army inspectors, and, like many another manufacturer who has had to deal with an inspector without experience, he's been on the verge of apoplexy several times. When I arrived the other day he had calmed down and was having a heart-to-heart talk with one of the inspectors, in his private office.

"Son," he said, in spite of the uniform and shoulder straps, "one of the first things you want to learn is that there are at least a few manufacturers who don't lie awake at nights to find new ways of cheating Uncle Sam. I'll admit there are some manufacturers who look on government orders as choice chances for what they call 'honest graft'—but there are a few exceptions. Not so much because of any saintliness, as because it doesn't pay. We've been building motors a good many years, son. Began when you were a youngster. Do you think we'd be alive today if we hadn't built pretty good motors and been fairly honest? We can't afford to give you a motor that won't perform as well as it ought. It would give us a black eye, and we don't like a black eye on our reputation any more than you do beside your nose.

Cheating Is Too Expensive

"I know it's your job to see that we don't put something over on you. But can you imagine how we can make one class of work for your motors, and another for our regular product? Or that we could afford to make up a few parts out of poor material, just for the sake of cheating Uncle Sam? It would cost a heap more money to make things below standard just for the sake of palming them off on you.

"One great trouble appears to be that your department hasn't much else to do but to write specifications. And not content with demanding a motor that will mote according to Hoyle, it starts in to tell us how to build 'em—and we've had a reputation for good motors for over twenty years. It seems to forget that the main thing it wants to buy is performance—dependability on the job. And yet it wastes its time by telling me whether to use a name plate made of brass or of aluminum, and whether to use raised or sunken letters on the oil gage. Why should it bother with petty details that only make trouble for you and for us, and don't affect the motor in the least?

"Then there are the motors you rejected because you thought the capscrews in the chain case were below standard. If you've got your gages here now, I'll show you that these screws are O.K. Not because we made 'em—for we didn't. But they are standard screws from a well-known maker, and it's just as easy for him to make them right as to make 'em small.

"Whoever adjusted your ring gage wasn't on to his job, son, as I'll show you if you'll hand over both the plug and the ring. You see your own standard plug goes into the ring gage rather loosely—sort of a sloppy fit. Now try the capscrews and, of course, they'll be loose in the ring gage. How could they help it? If you had a screw that was tight in that gage it wouldn't go in a tapped hole that was a good fit for your plug gage. The chap who set that gage for you wasn't on speaking terms with real gaging, and don't even know what tolerance means. So you see these capscrews are O.K. after all—and after delaying shipment a week or so, you can let the motors go through.

"But I'm a bit curious to know just what difference it makes to you or to the motors whether these capscrews are exactly the right size or not, so long as they are a good fit—and you say they are. Of course, you want to be able to use standard capscrews in places like that. But you didn't stop to see whether these screws were standard or not; you assumed that ring gage of yours was law and gospel on screws. And you've kept the army waiting for motors, and me waiting for my money. It's a case where the screws never should have been gaged at all. The boys in the shop have an idea that you felt you had to reject something, or else your superior would be wondering if you were really on to your job. So, as long as you couldn't find anything else, and the motors made good block tests, you just had to find something wrong.

Good Specifications Needed

"There's another point I'd like to get off my chest, too, son—though you've nothing to do with this—it's the fellows who write the specifications. They are obsessed with the idea that they must always have the very best quality whether they need it or not. They specify a minute-a-month clock, on an apparatus that only runs an hour at a time, when the cheapest clock movement made would do the job just as well. They demand more accuracy on one type of motometer than on another, just because they know one can be made closer than the other (and either one is amply accurate) or they would use the second type. It's all right to demand the best *where you need it*—but it's a waste of money to buy a ten-thousandth micrometer when you don't need any measurement closer than a sixty-fourth. Every refinement that you don't need means a waste of money.

"Just remember, son, that the main thing is to get satisfactory performance in motors or anything else. Also remember that it is highly important for the army to have adequate and reliable sources of supplies of all kinds. But if the specifications are written so as to make it hard for well-established and reliable manufacturers to supply what you need, you are likely to be out of luck when it comes to an emergency.

"We're all for Uncle Sam just as you are—he's our uncle too, you know. But when he lets any of his men make it impossible for us to do business with him on a satisfactory basis, we just have to look the other way when he asks for bids. We've got to do business in business-like ways or Uncle Sam gets left when the income tax collector tries to get his.

"You're young in the game, son, and I don't want you to get started wrong. Don't get the idea it's the inspector's job to reject all he possibly can. It's the inspector's job to pass as much as he is convinced will give thoroughly satisfactory service. In this way he helps Uncle Sam get what he wants, helps the manufacturer serve Uncle Sam with satisfaction to both, and helps the tax collector find an income to tax."

I thought Johnson had made up some of his items about foolish specifications, but he showed 'em to me in black and white. They may account for what appear to be high prices in bids tendered for some government supplies.

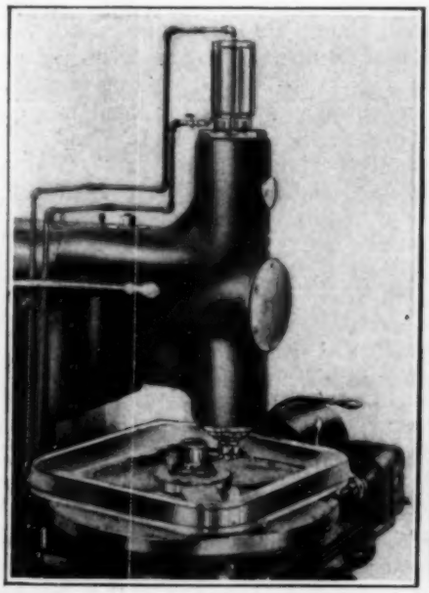
Unique Tooling Helps Build Maytag Washers

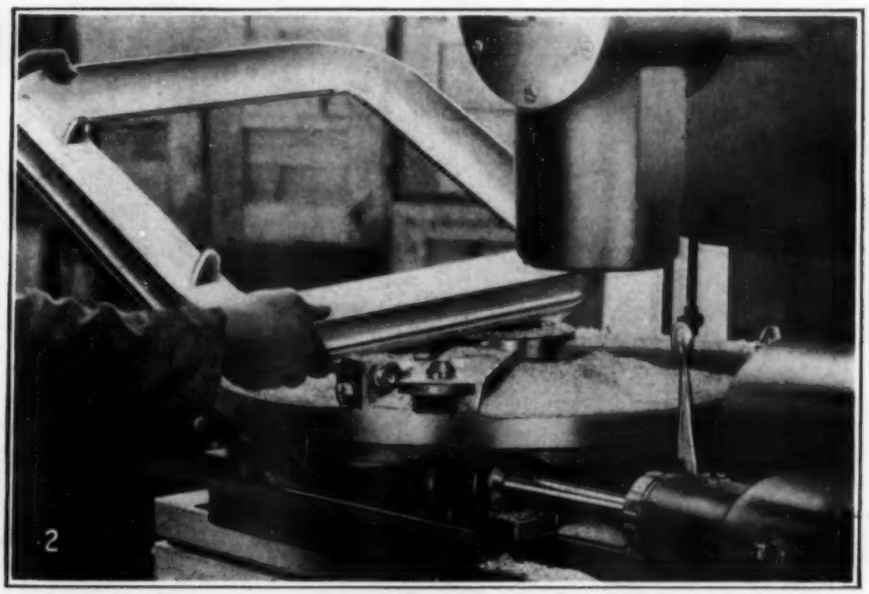
By Frank W. Curtis
Western Editor, *American Machinist*

Rotary-reciprocating fixture for tub covers—Multiple jig used with radial drill—Home-made duplex drilling machine for covers—Machining wormwheels and housings

A DAILY output of 1,200 household washing machines by a factory employing 1,700 men implies up-to-date methods and equipment. The Maytag Co., Newton, Iowa, is accomplishing just this and its machining methods and tooling are worth studying.

The square opening of aluminum tub-crowns is machined in a Milwaukee vertical milling machine equipped with a special spindle-head and a rotary table mounted on a reciprocating slide, as shown in Figs. 1 and 2. Operation of the rotary table is controlled by a gear box mounted on the right-hand side of the unit and driven by the universal shaft that usually operates the machine table. The work is located on four hardened buttons on the outer ends of the





Figs. 1 and 2—Milling aluminum tub crowns held in an air-operated cam-driven fixture

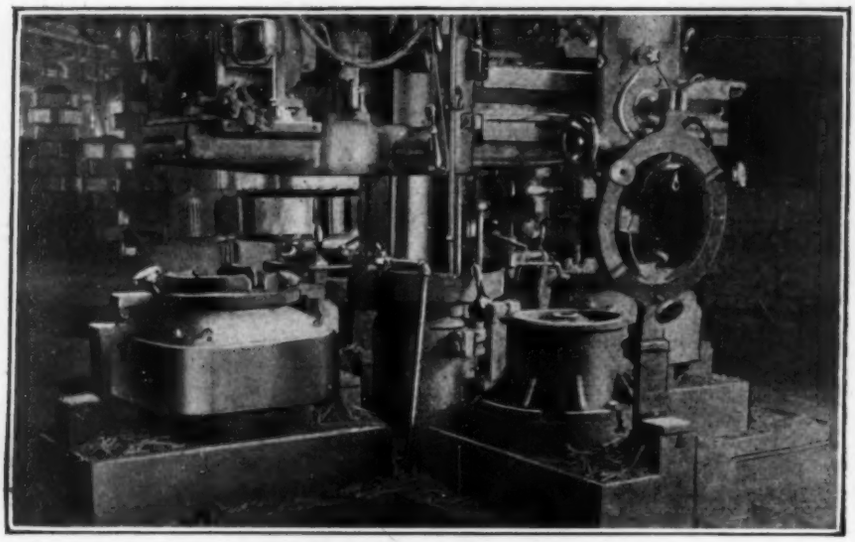


Fig. 3—Multiple drilling arrangement for tubs

clamping rams of the air chuck. Radial alignment is provided by two slotted rack-pins in the front of the chuck in which the lower edge of the crown enters. These pins are adjustable to accommodate variations in the piece. The air chuck, operated by a treadle, has four rams that have hardened, serrated toggle-clamps attached at their outer edges. The spindle of the machine, mounted on roller bearings, is automatically lowered to a cutting position as the air chuck is engaged. This movement is performed by a double-acting air cylinder mounted on the top of the spindle and connected to the chuck air line. The reciprocating slide then is operated by a crank to bring the work to a cutting position.

A barrel cam, connected through a worm and worm-wheel to a universal-joint shaft, is used to guide the work automatically in its path. The cam controls the reciprocating motion of the slide as the chuck rotates, a four to one ratio being provided. Upon completing one revolution the chuck is automatically stopped by a trip which engages a dog connected to the starting lever. The slide then is moved to the right until the cutter clears the work. At this point, operation of the treadle releases the work and raises the machine spindle simultaneously. Four springs, one in each ram, force the rams to a closed position, at the same time that the wedge of the air chuck and the cap of the air cylinder are returned by another spring. A 3-in. radius cutter, operated at 1,500 r.p.m., removes the gate and $\frac{1}{8}$ in. of metal, forming an opening that is 15$\frac{1}{4}$ in. in width. The height of the cut is $\frac{3}{8}$ in. A feed of 80 in. per min. is used. A floor-to-floor time of 40 sec. is possible,

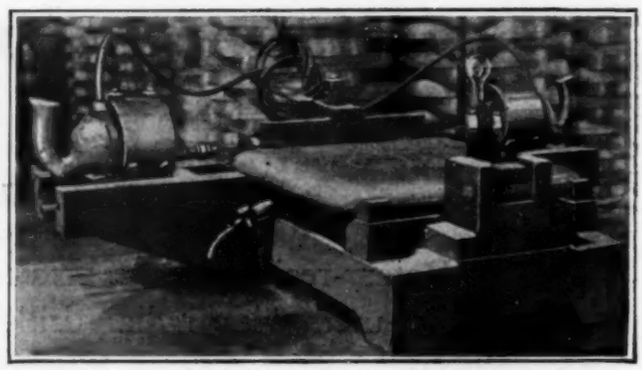


Fig. 4—Home-made duplex drilling machine

although 60 pieces per hr. is the average production.

Tubs, also aluminum castings, are bored to 6.75 $^{+\ 0.002}_{-\ 0.001}$ in. and counterbored to 8$\frac{1}{8}$ in. on the bottom in an American radial drill, Fig. 3. Four equally-spaced jigs, surrounding the column of the machine, have cam-locked leaves that clamp the work in place. A center locating plug, in each jig, is provided with a pilot bushing to guide the cutter. The cutter head is constructed with four boring and five counterboring tools that are set at a 30-deg. radial angle and a 30-deg. rake angle. The operation, performed by three operators, is accomplished by revolving the arm of the drill from one jig to another. One operator loads, another unloads, and the third runs the machine. They change positions periodically to relieve monotony. Approximately 10 sec. is required for the cutting portion of the operation and 5 sec. for the indexing of the spindle. A production of 1,250 pieces in 8 hr. is obtained.

The home-made double-head drilling machine shown in Fig. 4 is used for drilling two $\frac{11}{32}$-in. tap-drill holes for hinge pins in aluminum tub-covers.

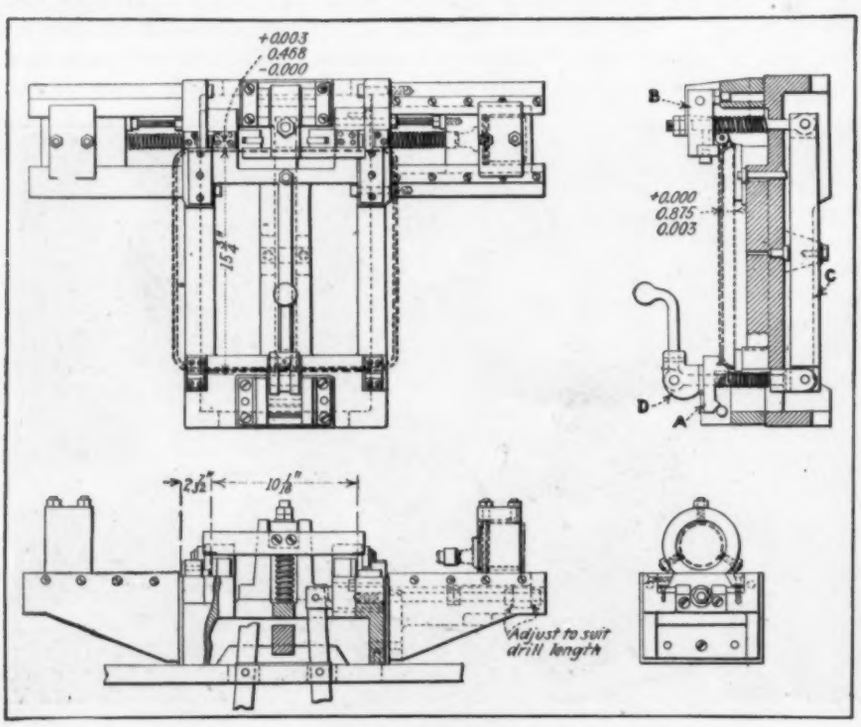


Fig. 5—Details of two-spindle drilling unit

It is equipped with two electrically-operated drills, mounted on slides that are controlled by a treadle arranged to produce an equalized feeding motion. Constructional details of the unit are illustrated in Fig. 5. The work rests on four locating pads and is held in place by an equalized-clamping arrangement that grips the work on two opposite sides. Two clamps *A* and *B* are connected to the bar *C* through adjustable eye-bolts. The locking cam *D* is adjustable to suit the height of the work. Springs return the drill slides to a neutral position when the foot pressure is released. Stops are arranged on the slides so a predetermined depth of $\frac{3}{8}$ in. is drilled.

Cast-iron wormwheels are bored, drilled, faced and turned in the Goss & De Leeuw 5-spindle automatic shown in Fig. 6. Three-jaw chucks, mounted on the spindles, hold the work by the cored holes in the web portion. The hub holes are finished

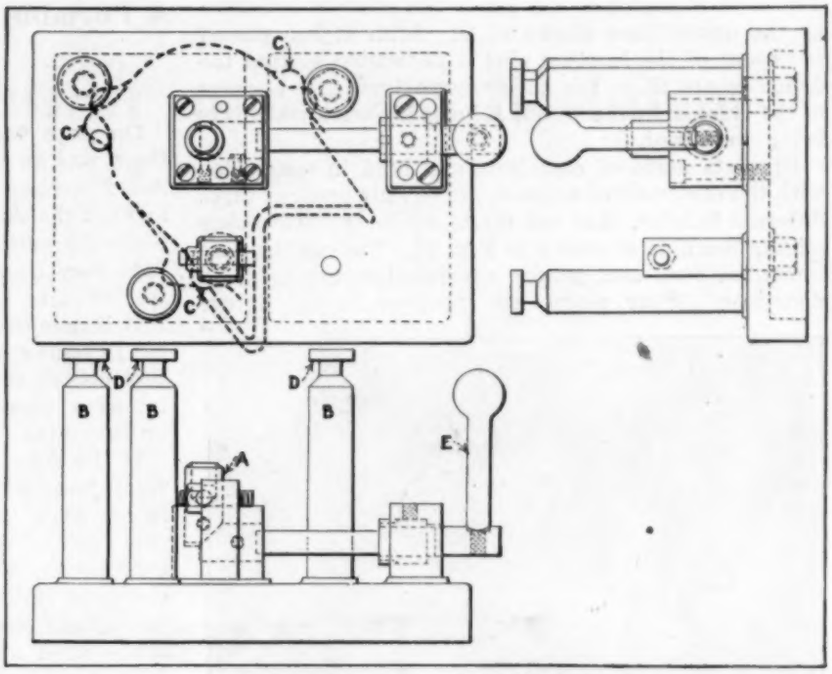


Fig. 9—Jig used in facing housing

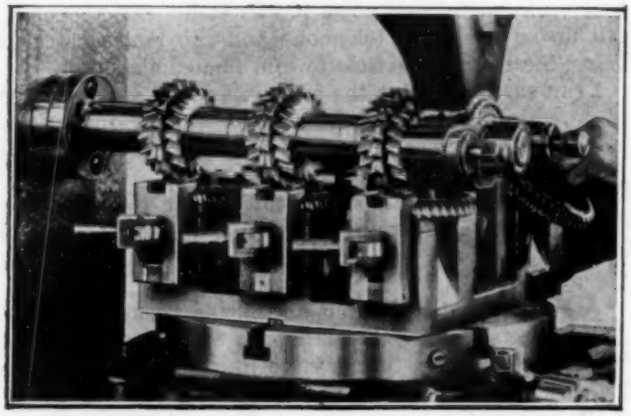


Fig. 7—Slotting and facing hub faces of wormwheels

to 0.622 + 0.001 in., and the outside diameter is turned to 5.2213 in. Snap, plug and face gages, used for checking the machined surfaces, are shown on the front arm of the machine. The machine is operated at 120 r.p.m., and 25 sec. is required to complete each piece.

After the teeth are cut the backs of the hubs are faced and slotted in a Milwaukee milling machine, Fig. 7. The fixture, mounted on a single-level-lock indexing table, is arranged to hold six wormwheels, three of which are in the cutting position while the other three are being loaded. The work is located on hardened plugs by its bore and on hardened plates by its outer edges. Double-clamping strap clamps, operated by an eccentric lever, are used to grip the angular face of the work. The $\frac{3}{4}$-in. slots are machined by the $4\frac{1}{2}$-in. interlocking cutter, and the hub portions are faced by the $\frac{3}{4}$x$3\frac{3}{4}$-in. cutters located next to them. The cutters are operated at 80 r.p.m. and 4-in. feed per min. to give a production of 225 pieces per hour.

A Moline "Holehog" is used to drill three $\frac{11}{16}$-in. holes, $\frac{3}{8}$ in. deep, in cast-iron bracket and crank housings as shown in Fig. 8. The work is located on three hardened studs and held by a swinging clamp operated by the handwheel shown in front of the work. Cams are used to feed the spindles, two of which are located at a 45-deg. angle to the center spindle. Their motion is continuous when the machine is in operation, and a cycle is completed in 20 sec. During this time the operator loads and unloads the work without stopping the machine. In front of the machine is shown a finished piece and the gage used for checking the holes for height and for angular position.

The facing of the inside boss, $2\frac{3}{4}$ in. in diameter, in relation to the finished flanged face of the housing, is handled in the jig illustrated in Fig. 9. As there is no outside surface that can be used for locating purposes, it is necessary to place the work in the jig, bottom side up, then, by means of the cam-locked plunger *A*, force it against the three overhead locating pins *B*.

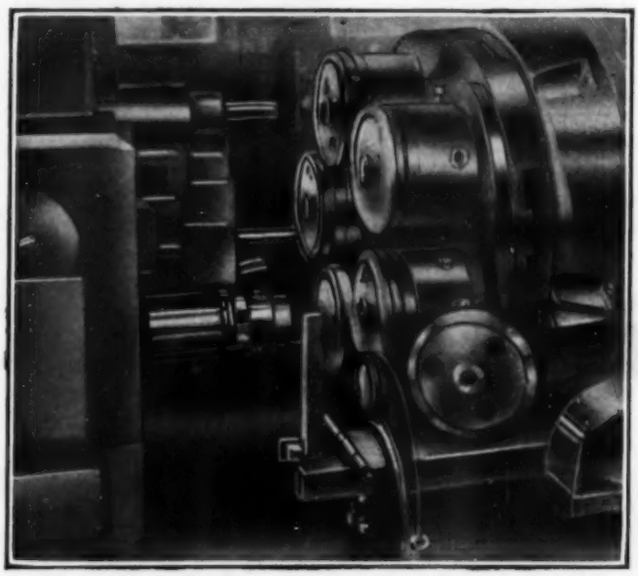


Fig. 6—Machining wormwheels in an automatic

The work is loaded in the jig in the position indicated by the dotted lines shown at *C*. After it has passed the heads of the locating pins it is twisted so that the flange bosses fit in the cut-away portions *D*. Locking of the plunger by the handle *E* holds the work while it is being machined.

Brackets made of cast iron, and used in connection with the center-drive assembly, have four pads, at three different heights, that are machined in the Milwaukee milling machine as shown in Fig. 10. The castings are somewhat frail and require careful clamping to avoid distortion. Four pieces are mounted in the fixture

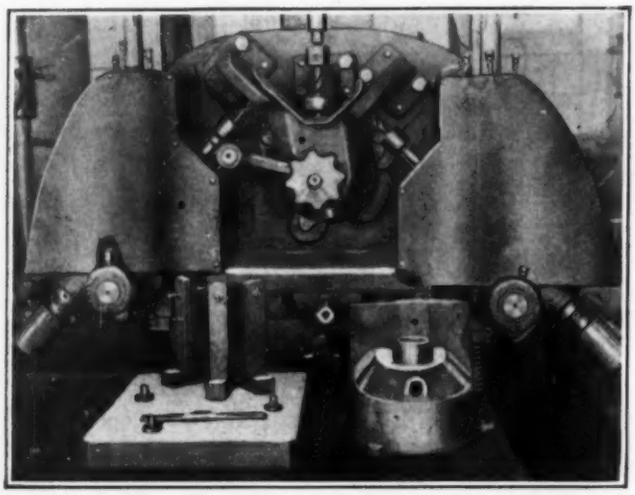


Fig. 8—Machining housings in a three-spindle drill

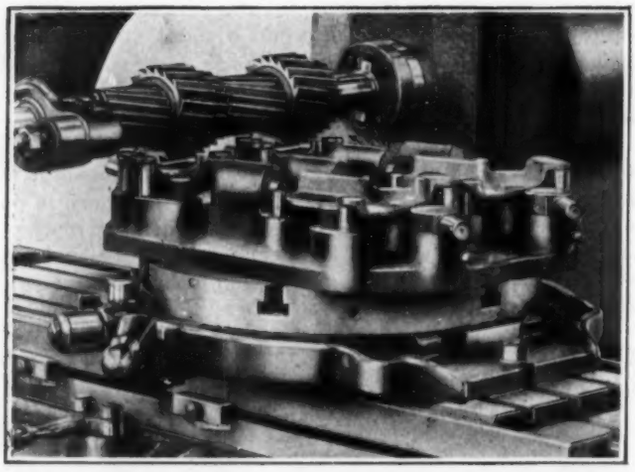


Fig. 10—Indexing fixture for milling brackets

which is attached to an indexing table. Each casting is located on three hardened pins and clamped by an eccentric thread-gripping lever. The operator loads two brackets while the opposite two pieces are being cut. Two sets of 20-deg. right-hand spiral cutters, comprising 2¼-, 3¾- and 4½-in. sizes, are operated at 65 r.p.m. and a 5-in. per min. feed. A production of 100 pieces per hr, is attained.

(To be concluded)

It is said that where cutting oil is used, there are about 2 gals. of oil in every bushel of metal chips. At 30 cts. a gal. here are 60 cts. to be thrown away or recovered by an oil extractor. If you use only a few barrels of oil a year it pays to consider this saving.

A Portable Office in the Machine Shop—Discussion

BY STORRS T. RICHMOND

On page 954, Vol. 64, of the *American Machinist*, there was an illustration of a portable office used in a San Francisco machine shop. Is it true that the office and not the illustration was used in the machine shop? Since the article did not give any of the advantageous uses, may I ask what they are? Has the foreman flat feet or is he otherwise handicapped?

It is rare that the workmen have access to telephones, but in some cases perhaps they have. It is just possible that one of the workmen may have to call the superintendent from the outside by telephone for instructions or something.

If the doors of the building are adequate, there is a faint possibility of the superintendent running home in his office, "a la bus," for a cup of coffee or so. In this case, of course, the office will have to run on its own power, which I suppose would be electric and conveyed through a trolley, making it possible to be run up any street where cars travel. This would necessitate head and tail lights and a road registration.

Why not put the toolroom on wheels? Then a workman requiring a certain tool, fixture or jig could step up to the office, when it was in his neighborhood, call up on the office telephone and the toolroom could bring the required article to him immediately.

I can easily imagine the superintendent, getting tired of a certain location in the shop, calling for a few helpers to shove the office to a new and more attractive part of the shop.

Of course, the toolroom is heavier than the office, but to comply with the rules of the factory mutual, a man could precede it when in transit, with a flag—perhaps not a red one.

A steering wheel, clutch and brake pedals would be great assets in that the occupant would feel more at home, especially on Monday morning after a strenuous Sunday drive.

There are disadvantages as well as advantages about this plan of a portable office. Suppose the sweeper in cleaning under it had to move it to do so, and mislaid the office—but what is the use? Give me the permanently located office with a telephone, heating coil, wash bowl and a swivel chair or two and I'll keep out of the workmen's way. Then I will know where I work and so will the men. I want glass enough around the office so the men can see me.

The idea is certainly a novelty, but how in the name of good living did it get by the management?

Some engineers seem to be always proposing new terms such as "deviation" for "allowance," etc. It isn't so much the exact name used as in having its use understood. Isn't it better to standardize on names, and eliminate all we can than to add new ones?

Those who remember the early days of milling, when a fine tooth cutter nibbled away at steel at an agonizingly slow rate, are often astounded at some of the modern milling cuts. A milling cut ⅜ in. deep and 5 in. wide in soft steel at the rate of 30 in. per min. or a cut ½ in. deep and 24 in. wide in 0.65 carbon steel at 6 in. a min. is almost unbelievable.

Standardization as a Cost Reducer

By B. M. Smarr
Director, Standards Section General Purchasing Committee
General Motors Corporation

Appreciable savings are possible through standards work within the company—How best to get results—The type of man needed for standards work

WHAT is to be gained by standardization work within a plant or in the several plants owned by a big manufacturing enterprise? The answer should be obvious to anyone who has paid any attention to the really remarkable results obtained by Secretary Hoover's Division of Simplified Practice in the Department of Commerce. The simplification of milling cutter and grinding wheel sizes alone is going to mean a saving of many thousands of dollars every year to users and makers of these common shop tools. And these particular projects have only just been started. More savings are possible as future meetings of the parties interested discover other sizes that will never be missed when they are eliminated from the list of standard sizes.

It is true, of course, that the individual company aiming at such standardization as it can accomplish within its own walls will hardly meet with the degree of success that has attended the work at Washington with the powerful personality of Herbert Hoover behind it. Nevertheless, a great deal can be done if the right methods are adopted, and the savings possible to secure are considerable.

Price Reduction Possible

The keynote of the plant standardization campaign should be the elimination of useless sizes and varieties. The natural result will be that greater quantities of the sizes and varieties that remain will be needed and they can therefore be purchased in larger quantities. The price per piece will automatically reduce itself.

The general principle just stated is of universal application. Odd sizes and varieties are almost invariably born of some emergency. Before you know it they become accepted and the next man who specifies their use does so because he believes that it is essential, that a real reason for so doing exists. Go into any factory you please and you will find case after case of this kind. And in 99 cases out of 100 you will find that if there was a reason at one time it has long since ceased to be. Therefore, a study of the reasons for doing things is prolific in results. Experience shows that it is almost invariably possible to reduce the number of sizes or varieties of a given type of unit 50 per cent. When you have made such a saving you have established a strong selling argument for your project and the other fellow wants to get in and help. He gets to thinking about the possibilities and shortly works himself into a frame of mind where he is willing to consider compromises and do a little giving in a give and take discussion.

After a general analysis of the standards situation the best point of attack is usually evident. The next step is to make a detailed analysis of the item chosen for standardization, remembering always that if there is any doubt of the value of retaining any particular size it should be considered a special. The culprit here is guilty unless his innocence can be proved—just the opposite from the theory of the law courts.

Here are two instances of real savings made possible by analysis for standardization. The suggestion was made that stove bolts be substituted for machine screws. No trouble was encountered until the ¼-in. size was reached in which size the number of threads on a machine screw is 20 per inch as against 18 on the stove bolt. Nobody knew why the stove bolt had to have 18 instead of 20 threads. The makers said it was demanded by the stove builders. A letter to the stove builders brought out the information that they used them only because they came that way, that 20 threads would be just as usable as 18. That removed the difficulty.

Then the objection was raised that the single-blow header used by most stove bolt manufacturers would not give the same size head as the double-blow header used in making machine screws. Experiments showed that it was possible to get as large a head with the single-blow machine as was used for the average machine screw, so the standard head was determined upon as the largest one easily possible from the single-blow machine. Any manufacturer who wanted to use a double-blow machine was at perfect liberty to do so. All that was necessary was that his product conform to the standard.

Uniformity Attained

Then came the test of the new standard. One company placed a large order for stove bolts to the new requirements. It was filled, and at the same price as the previous order. Then another company fell in line and placed a similar order. The upshot was that within a very short time the price was reduced 15 per cent. Not only that, the bolts from different makers, formerly not interchangeable, were brought to practical uniformity.

Another definite figure on savings possible is had from the change of the head on a U.S.S. cap screw to the same size as the head on the S.A.E. cap screw. In one plant this change will save $4,000 a year on one major assembly alone. In addition there is an appreciable reduction in the number of wrenches needed.

Not every case can be made a standard, of course. There are exceptions, justifiably different, that should be set up as specials to be used with discretion. They will generally be eliminated in half the cases where they were formerly used.

It is one thing to establish a standard and quite another to get it adopted, as the engineering societies have learned from sad experience. There is a tremendous amount of just plain inertia to be overcome. And on top of that the natural dislike of many active executives for anything that savors of distraction from staff activities. Consequently it is up to the standardizer to move with great circumspection. The principal function of the men connected with a standards department is to act as a co-ordinating force. As such they should be careful not to initiate anything in the way of detailed fact but should endeavor to draw the information from production executives.

One way to get results is to go to the production man with an example of the savings made by some parallel piece of standards work. Tell him what is needed to solve the immediate problem in hand and the chances are that he will start to get the answer you want in the hope that his department will profit by similar savings, as it most certainly will if the project is carried through. It is essential to insure that the production men get credit for any standardization work that their efforts may have helped along.

Means Higher Profits

As to the suppliers of standardized products, they will fall in line if the standard is within reason, and there is no excuse for promulgating a standard that is not. The establishing of a standard means that they will be able to manufacture larger quantities of a given size and to eliminate some of the odd sizes. As a consequence, the production cost drops and they can increase their profits even though they pass on part of the saving to the customer.

Incidentally, the small consumer of the product can also save if he will adapt his product to the use of the new standard.

The ideal man for standards work is one who possesses a keen analytical mind and an unfailing supply of tact. He is rather a scarce article. His principal job is stirring and boiling the standards pot until results rise to the top to be skimmed off and put into practice.

Much standardization grief, from the company angle, can be avoided if there are existing standards that can be adopted bodily. Several tests must be applied to such a standard however. How old is it? Is it so new as to be untried, or so old as to be out of date? Is it actually in use, and if so, to what extent? If not, what can be done to make it acceptable? Sometimes a new standard will go through because there is no general resistance as there might be to an old one that had failed of general adoption.

In the absence of a national standard for any particular item, the General Motors Corporation sticks to its own standards. For the use of the Purchasing Departments or the designers there is only one source of complete information that has been approved by all operating units, the General Motors Specification. The manufacturers' catalogs are seldom complete.

To facilitate the purchase and use of parts and materials to General Motors Standards Specifications, each individual part or material is assigned an arbitrary number which is printed on the specification and broadcast liberally among the manufacturing divisions and their sources. Material specifications begin at number 1 and the number is followed up by an M, designating material. Standard parts are numbered from 100,000 to 150,000. Each plant has its own section of numbers for specially designed parts, i.e., one plant's parts fall in the 150,000 to 250,000 group, another plant's parts from 325,000 up, etc., etc. This arrangement makes unnecessary any duplication of part or material numbers within the different branches of General Motors. Each subsidiary uses the published numbers for standard parts and materials and its own numbers for the specially designed parts.

Where individual drawings of standard parts are required the Standards Section makes and holds the tracing. Manufacturing branches and sources of supply are furnished with van dykes from this original tracing. Only one part number and one original tracing of a standard part keeps any changes from creeping in which may affect the serviceability or interchangeability of the part itself.

From what has been said it is hoped that it has been made clear that standardization within a company or a combination of companies is not an easy task. It requires a great amount of detail work and patience, extreme consideration for the men and things affected, but the ends attained are justified in the satisfaction that comes from a job well done and in very substantial financial savings as well.

Modernize Your Shop Building

By B. J. Stern

There is a firm on Long Island whose officials have evidently taken to heart the articles in the *American Machinist* on the replacement of obsolete machinery. Each week sees a load of old worn out mechanisms going out and trim new machinery coming in, one modern production "go-getter" sometimes taking the place of two or three of the old timers.

What I witnessed there while some new machinery was being brought in caused this thought to come to my mind. While the commendable slogan of your magazine is "modernize your old machinery" there is no corresponding whisper of modernize your old building so that new machinery can be taken in and old equipment taken out without any trouble.

The company referred to occupies a concrete structure not ten years old. The only way machinery can be gotten into this plant is through the freight elevator. One of the firm's latest acquisitions is a multiple drill press, the top of the main driving spindle standing ten feet from the ground. With it arrived the problem of how to get it up to its destined place on the third floor. It was necessary to engage an outside rigging gang who manipulated the machine through the shaft of the freight elevator by means of block and tackle and endless swearing. When after ten hours of hard labor the drill press stood on the third floor, its spindle was badly bent at the top where it had collided with the elevator shaft.

Why cannot industrial buildings like the above be built with openings on every floor covered by a rolling door, this doorway to be used for taking out and bringing in equipment or heavy materials? An I-beam can be fastened to the roof, projecting out directly over these openings, very much as a barn is built. It would then be an easy matter for a truck to back up under the doorways, and simply pull the equipment up and swing it in at the opening.

Why the Machinist Sticks

By Loring Roper

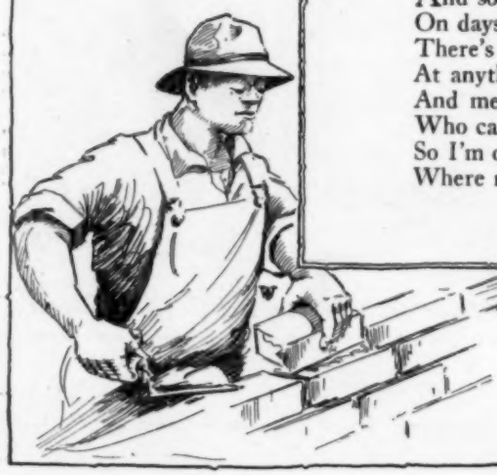
Lord knows it isn't the money
That's kept me here in the shop,
And many's the time I've been tempted,
To throw up the job—and to stop
A-using the skill and the knowledge
That comes from long years at the trade
And double my wages at building—
But I'm foolish I guess—for I've stayed.

For somehow I can't seem to chuck it
Though wages be double or more,
And I can't help but feel a bit grouchy
Without something to even the score.
But I can't quite see handling a trowel
And slopping with mortar and tile
When I'm used to fine work in the toolroom
Or a delicate touch with a file.

There is joy in the knowledge of turning
A piece, or of grinding it true,
To know that all industry's hanging
On other mechanics like you.
To know that your eyes and your fingers
Can fashion and build for its need,
That in iron or steel, to split thousandths
Needs more and more men of your breed.

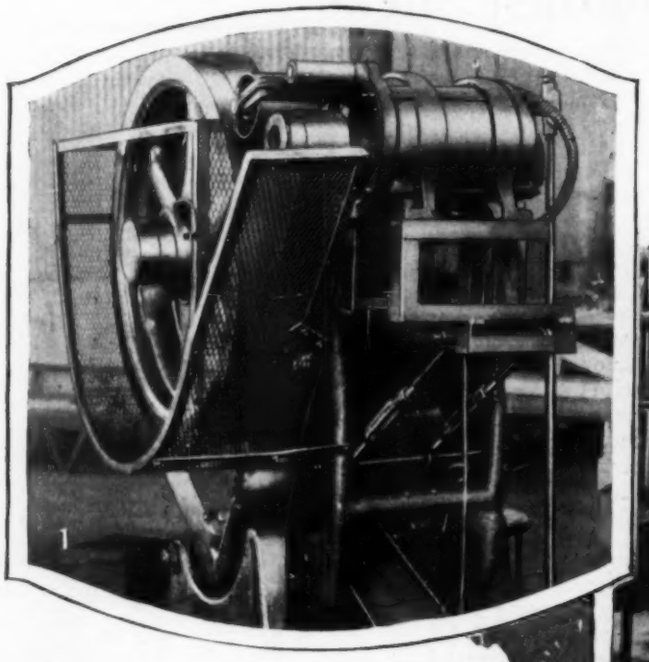
No matter what product you're using,
Be it steel, silk, granite or hay,
Behind it machines and machinists
Produce it—for rates you can pay.
Typewriters, motor cars, stockings—
Take anything, whate'er you will,
You'd be living in dugouts and caverns
If it weren't for mechanics with skill.

Lord knows that it isn't the money,
For other trades double our pay;
It's the joy that we take in the knowledge
Of the skill that we all must display.
For there's great satisfaction in knowing
That with trained eye—and fingers to feel
You're a wizard at making and fitting—
That you've learned the great secrets of steel.

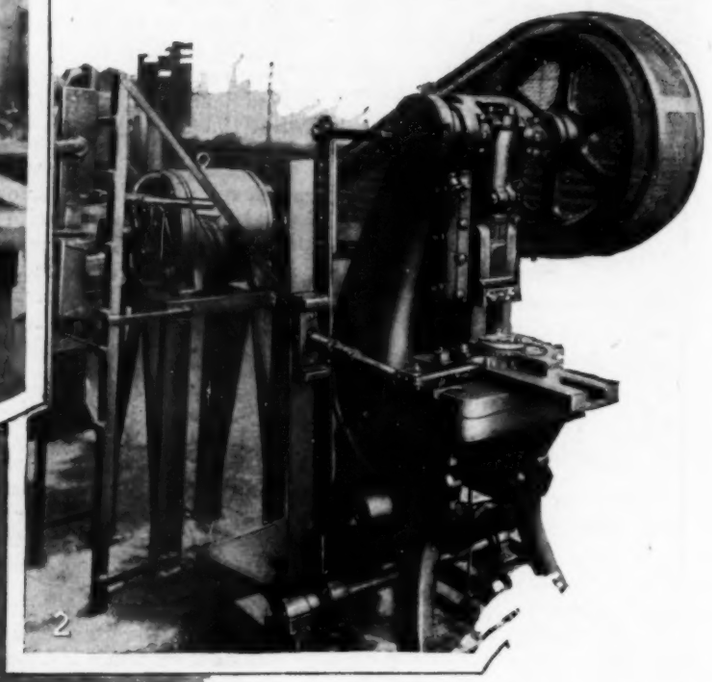


And so, though I'm not always happy
On days when my pay check comes round,
There's a joy in the work I'd be missing
At anything else, I'll be bound.
And mechanics we're needing a-plenty
Who can carry-on well in the trade,
So I'm one of the gang who is sticking
Where machines and mechanics are made.

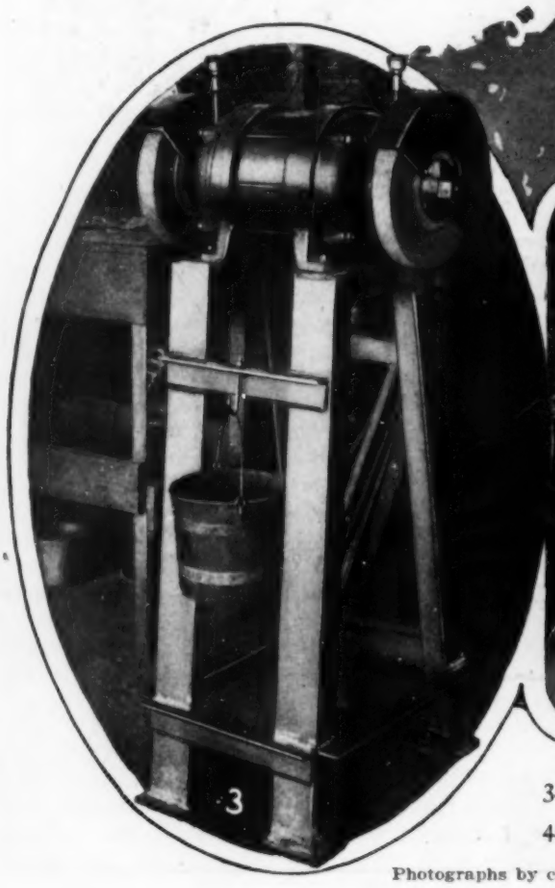
Saving Money by Arc Welding



1—How welding helps make a motor mounting



2—Another method of supporting the motor for a punch press

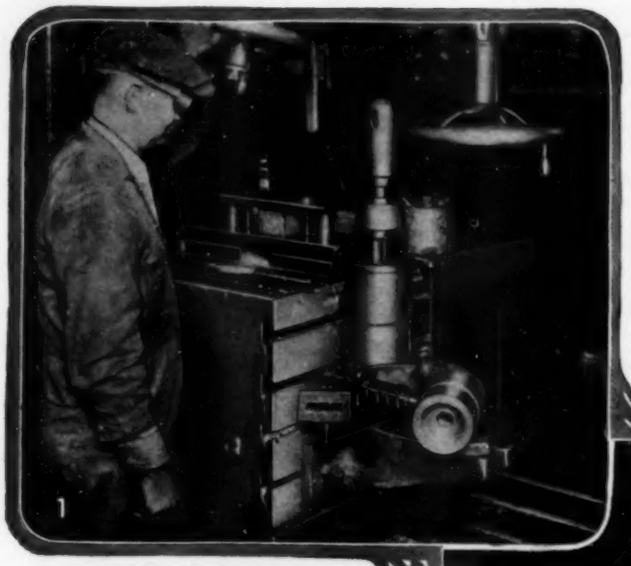


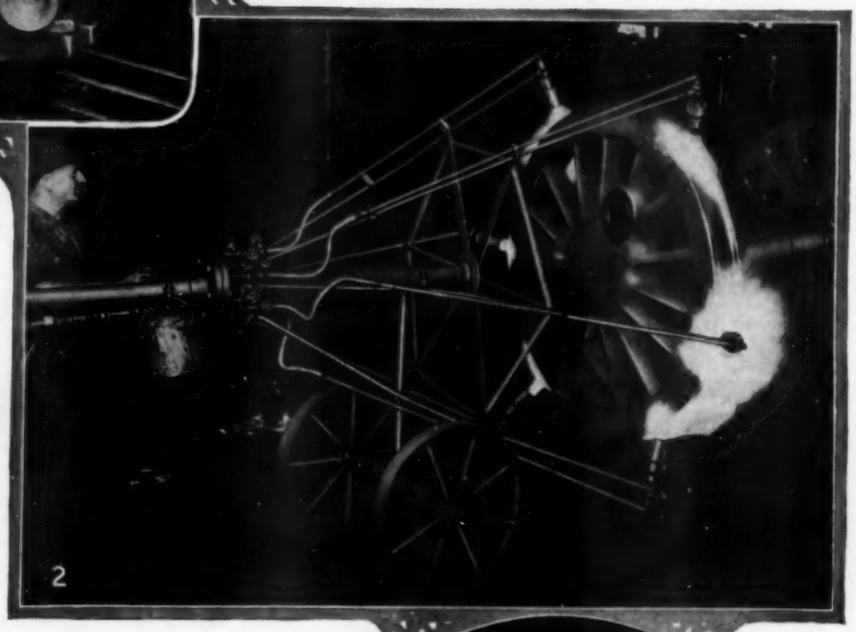
3—Grinding stand welded from angles

4—Storage racks, welded—and bolted, compare them

Photographs by courtesy of The Lincoln Electric Co.

Devices on the Lehigh Valley



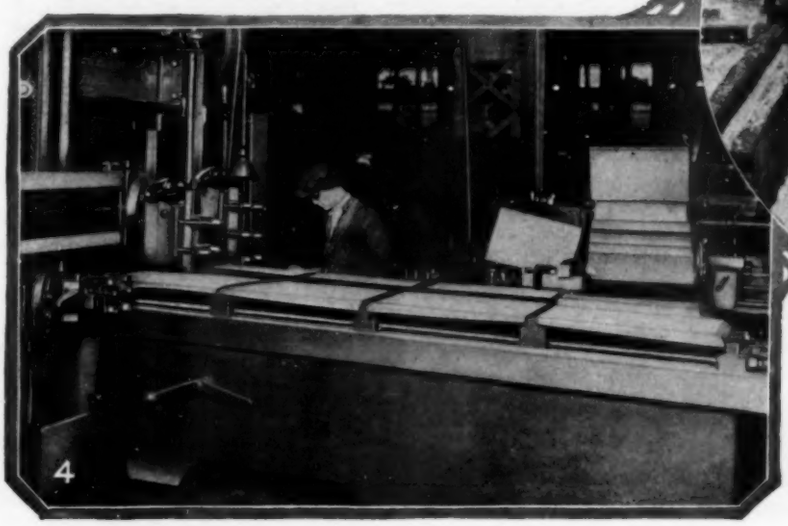


1—Drilling 1¼-in. hex. hole for pin-plate bolt in crankpin with Watts drill

2—Oil heater for removing tires. Average time 4 min. Adjustable for different sizes

3—Air jack for handling car wheels

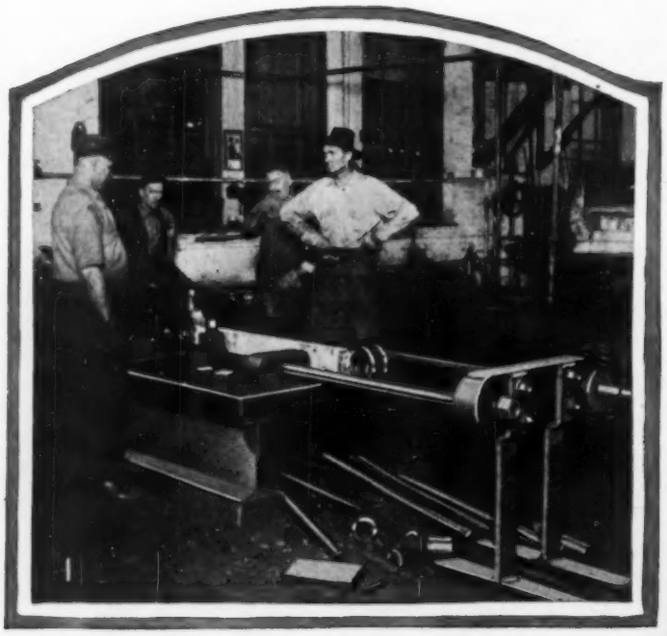
4—Fixtures for planing shoes and wedges at the same time



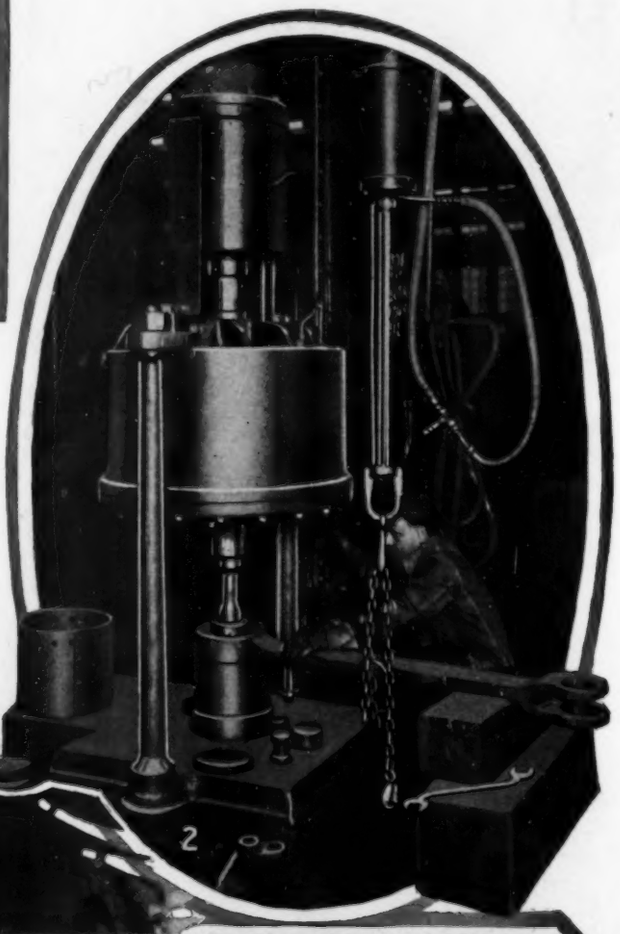
Photographs from the Sayre Shop by courtesy of the Ingersoll-Rand Co.

Photographs by courtesy of The Lincoln Electric Co.

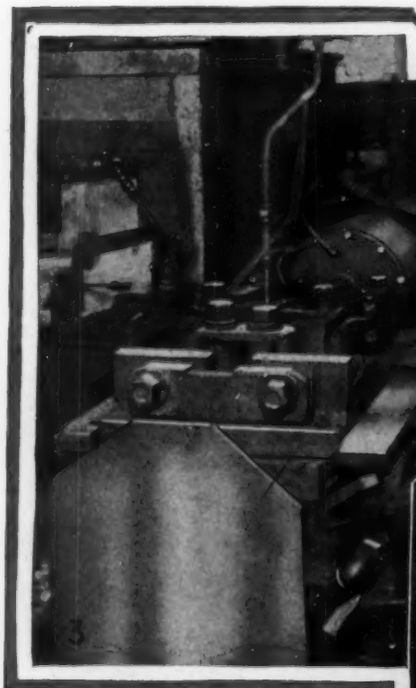
Air-Operated Presses and Bulldozers



1—Shortening locomotive side rods in air-operated bulldozers



2—Pressing in side rod bushings



3—Bulldozer for heading rivets and bolts

4—Upsetting end-gate hinges for composite cars

Photographs from Pittsburgh & Lake Erie shop, McKeesport, Pa., by courtesy of the Ingersoll-Rand Co.

Automotive Production

How Production Methods Vary in Shops Building "Light Sixes"

By Fred H. Colvin
Editor, *American Machinist*

Fixtures for centering and holding crank cases—Special milling heads—A two-station boring fixture—Unusual devices for insuring alignment when Cleveland parts go to assembly

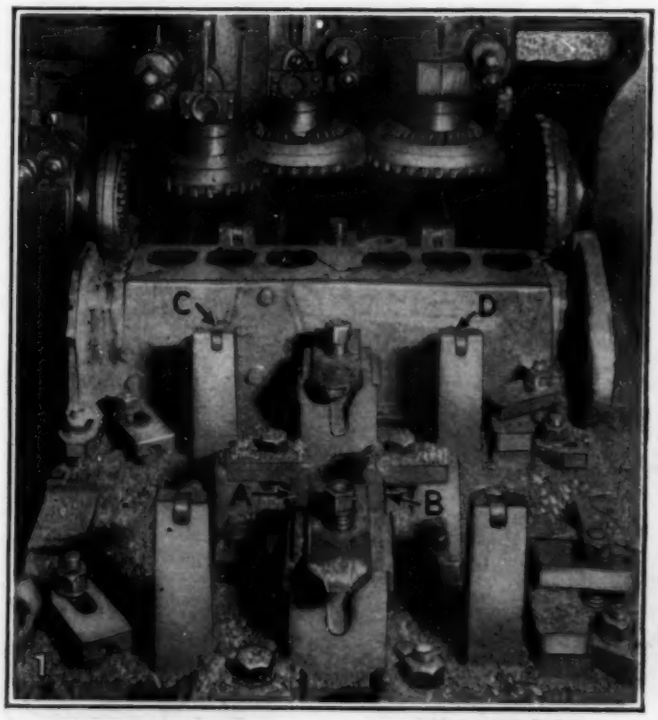
SEVERAL of the milling and other fixtures used in machining the crankcase for the larger Cleveland engine are unusual in design and particularly efficient in operation. They are of the type that has made possible the building of cars with the accuracy necessary for satisfactory service, at a cost that would have been impossible a few years ago.

Beginning with the milling operation, Fig. 1 shows the five cutters for roughing the ends and top of the crankcase. The three vertical cutters are so arranged that they cover the whole surface. The ends are milled by the horizontal cutters.

The fixtures are unusual, in that they equalize the casting endwise from the center bearing by means of the jaws *A* and *B* that are hinged at the bottom and are forced inward by the wedge-shaped clamps. The nuts for tightening the clamps are reached with a socket wrench through the crankcase openings. The crankcase is clamped to the fixture by the lower flange. The thrust on the upper part of the crankcase is partly taken by the stops *C* and *D*, which are hinged screw jacks. One of the finishing cutters can be seen at *E*. In Fig. 7 details of the centering jaws and side stops are shown.

Milling the pad for the generator is not an easy job on account of its location. The special head in Fig. 2

The sixth article. The seventh will appear in an early issue.



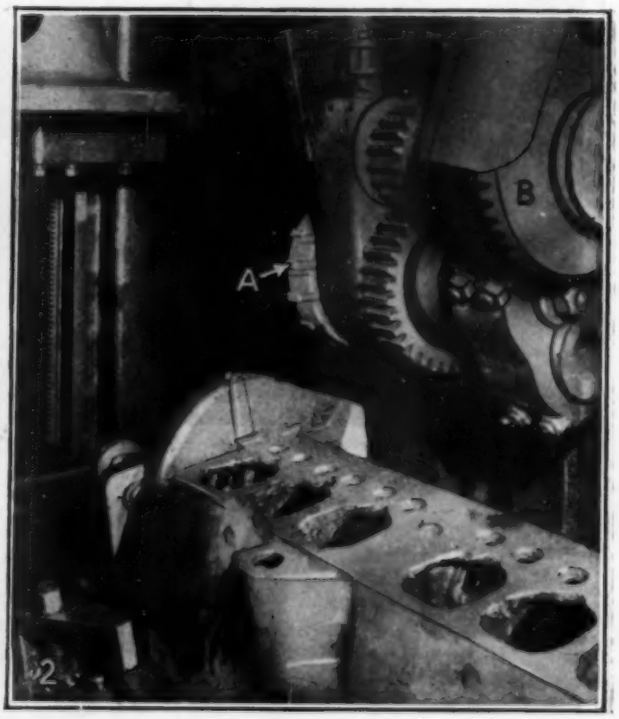


Fig. 1—Milling the top and ends of case. Fig. 2—Special milling head for generator pad

Automotive Production

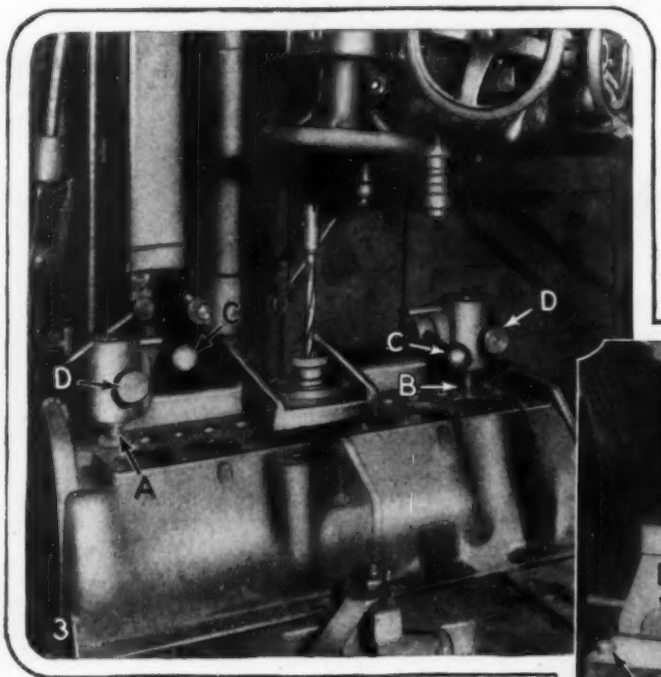


Fig. 3—Drilling for distributor shaft

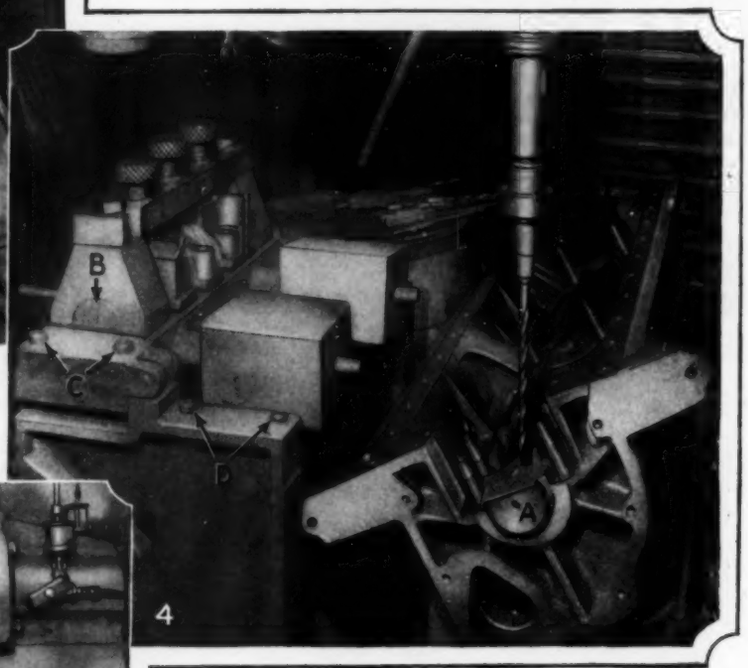


Fig. 4—Drilling caps and bearings

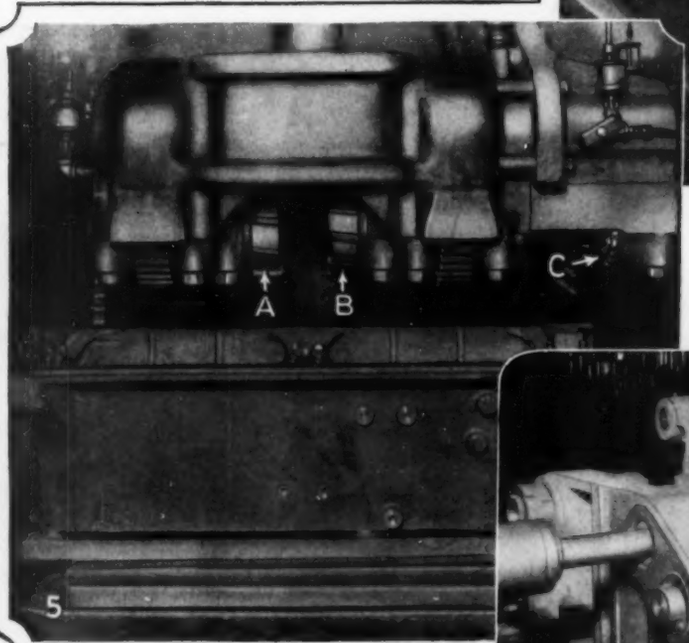


Fig. 5—Milling the center bearing

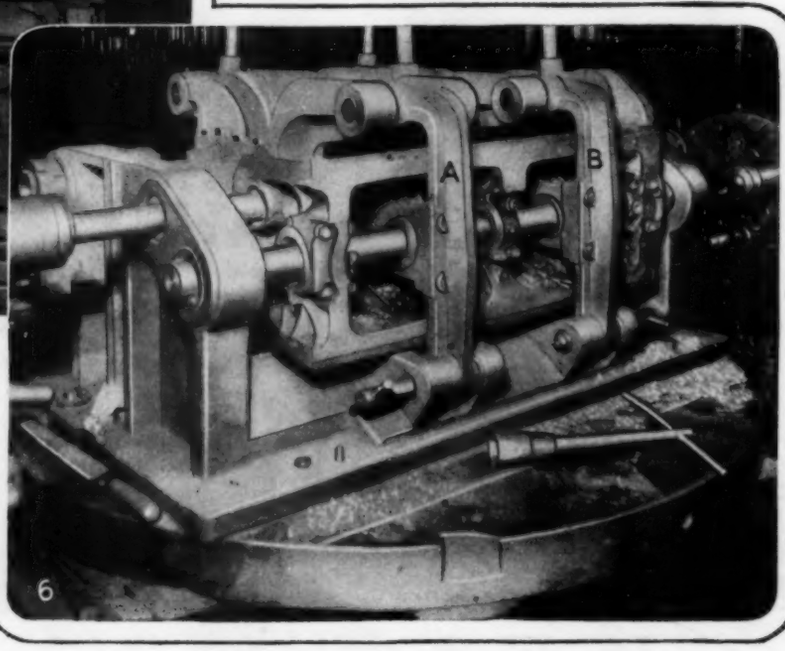


Fig. 6—Finish boring crank and camshaft bearings

Automotive Production

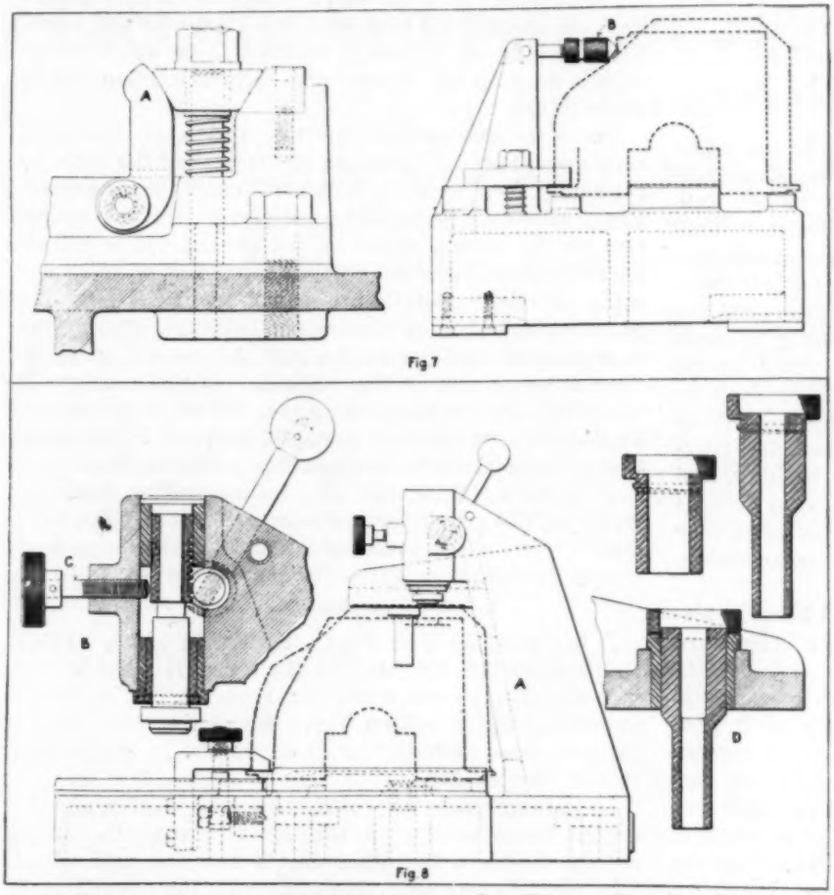


Fig. 7—How the centering jaws work. Fig. 8—Details of the drilling fixture

was designed to handle this operation and requires little explanation. The cutter *A* is on the end of a well-supported spindle, driven through the gearing shown, the upper shaft being driven through bevel gear *B*.

The locating points in the crankcase are the two end valve-tappet holes shown at *A* and *B* in Fig. 3. These holes are utilized for location in the operation where the hole for the distributor shaft is drilled. The locating plungers, or dowels, are operated by the ball handles *C* and are locked by the screws *D*. Details of this fixture are shown in Fig. 8. The end of the case is indicated at *A* as well as the method of locating the work. The construction of the locating plunger can be seen at *B* where the rack and pinion movement, together with the locking screw *C*, is shown. The removable locking bushings are at *D*.

Oil holes, both for the passage between the main bearings and the camshaft, and in the bearing caps, are drilled on the machine in Fig. 4. The bar *A* in the bearing has drill bushings at the proper angle for reaching the camshaft bearings.

The bearing caps are held in the fixture at the left. The bearings are located on the bar *B*. After clamping, the fixture is turned over so that the pins *C* rest on the pins *D*, and the holes are drilled through the bar *B*, as in the case of the bearings themselves.

After the bearing caps are bolted in place, the center bearing is faced on each end, since it takes the end thrust of the engine. The crankcase is located by dowels in end valve-guide holes, under the special milling head, in the Moline machine shown in Fig. 5. This head has two spindles, each carrying one of the large milling cutters *A* and *B*, and both driven from a shaft above. At the same time the small cutter *C*, on the right, mills the oil-slinger groove, as with the smaller engine illustrated in a previous article.

The main- and camshaft-bearings are finish bored in the fixture in Fig. 6. The fixture is double, so that one side can be loaded or unloaded while the work in the other side is being operated upon. It is indexed 180 deg. between operations. The boring bars are pulled through the work instead of being pushed, as is usual. The case is held by the clamping arms *A* and *B*, which also carry the guides for the boring bars. The arms are counterbalanced at the top, and stay up out of the way while the case is being handled in and out of the fixture. It will be noted that the machine is of the duplex type, and that it is equipped with two heads, one at each end. The heads move away from each other when the machine is in operation, the bar for boring the main bearings being pulled toward the right, while the bar for boring the camshaft bearings is pulled toward the left.

By pulling the bars, they are kept under tension and there is no tendency for them to buckle under the feeding pressure, as would be the case if they were pushed. By this method of feeding there is no likelihood for the bearings to become out of line, due to the boring.

Hardening-Room Practice—Discussion

BY E. P. BARFIELD

The article by John J. Kauffman, under the title given above, published on page 757, Vol. 64, of the *American Machinist*, has been read by me with considerable interest.

While appreciating the fact that some of the hints given by Mr. Kauffman are very valuable, I must take exception to the phrase: "The electric furnace with recording Pyrometer is *without doubt* the best equipment obtainable." (The italics are mine.)

Perhaps Mr. Kauffman has not heard of the electromagnetic method of hardening. This is surely superior to any pyrometer, inasmuch as instead of relying upon the temperature and time determinations, the operator is directly informed of the exact moment when the last trace of pearlite is converted into austenite.

Incidentally when this method is employed, it is no longer necessary to allow one hour of heating for each inch of thickness of material, thus saving time, oxidation and expense.

Handling Locomotive Repairs to Meet a Scheduling System —Discussion

BY H. M. WESTBROOK
Shop Superintendent, Grand Trunk Railway System
Battle Creek, Mich.

THE very interesting review of railroad-shop practice on page 434, Vol. 64, of the *American Machinist*, would be of less value did it not call forth any questioning or discussion. A desire to find the best method of performing standard operations like some of those described, prompts me to ask a few questions relative to these and to offer some suggestions.

Why, as in Fig. 6, is it still found necessary in some shops to mill the valve bushing ports? Many shops are simply cutting a ¼-in. groove about ¼ in. deep in these bushings from the inside, while they are set up for boring. It is claimed that this groove-cutting operation can be accomplished in 12 min. per bushing, and answers the purpose in every respect quite as well as going to the trouble of milling the ports, and costs very much less. This practice is believed to be standard in many shops.

The description of cutting the elongated holes in piston rods in Fig. 7 does not show how the holes were drilled central, leaving it to be assumed that a jig was used. This item would have been more informative if the jig had been shown. It also fails to explain how the correct angle of the ends of the keyway for draw was maintained. I presume the holding fixture was made to fit the slot in the milling-machine table and was planed the desired angle so as to accomplish this purpose automatically when placing the rod on the fixture.

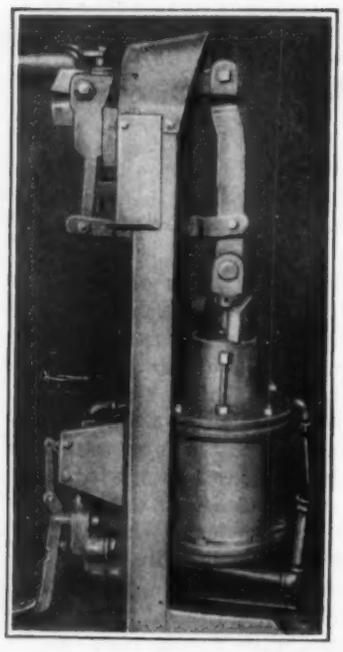
Why drill both holes? We have found that but one hole is necessary, letting the milling cutter do the rest. The time would be cut down considerably were the second hole not drilled. The use of a ⅛-in. milling cutter indicates that two cuts are taken. Could not a cutter of the correct diameter be used for a long time or until requiring to be ground, thus saving the time of taking the second cut? I have seen 56 of these keyways milled and the cutter was still in good condition, although it had been used at high speeds and feeds. The life between grinds is believed to be due to thoroughly flooding the cutter with a good coolant, while in operation.

The hose dismantling machine shown in Fig. 8 is very good, but the operation of "loosening the clips by pounding them with a hammer" could be improved. Fig. 1 shows a simple method of performing this operation on the return stroke of the shears. It is merely an attachment fastened to the piston rod of the operating cylinder. Details are shown in Fig. 2. By the use of this method of nipping the bolts and opening the clamps on the return stroke, and the method of stripping them shown in the article under discussion, it should be easy to strip, complete, 115 air hose per hr. In fact, the writer has seen 145 stripped in one hour when a special demonstration was being made.

It is hoped that this bit of constructive criticism may result in suggestions offering still greater improvements. The whole machine is shown in the hope that it may contain suggestions for some other shop.

It is sometimes a bit funny the way in which we look at the other fellow's job. I knew a coal miner who was scared stiff to go into a machine shop because he feared something might fall on him. We of the shop look at the coal mine as being really dangerous in comparison to our own calling.

In the same way we probably waste a lot of sympathy on the fellow with a job that looks hard to us. In an automobile shop, the other day, I saw two men whose jobs were to put nuts on underneath the chassis as it rolled over them. They were flat on their backs, on cushions, of course, and it seemed as though such a job ought not to last over an hour or two at a stretch. But the men, instead of craving pity, felt that they had the easiest jobs in the shop and were entirely contented.



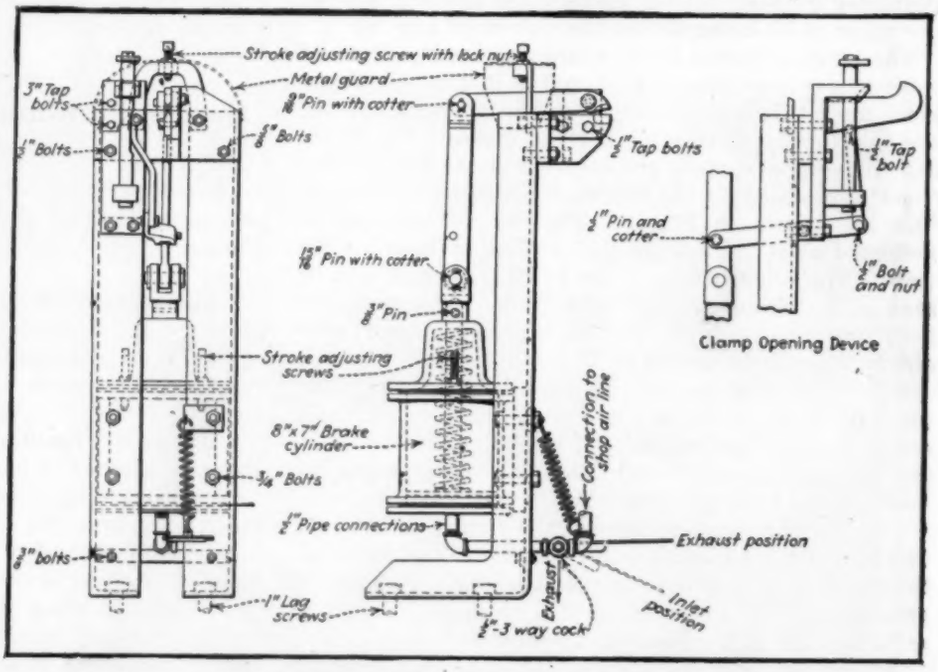


Fig. 1—Air hose clamp-clipper and spreader. Fig. 2—Details of the machine

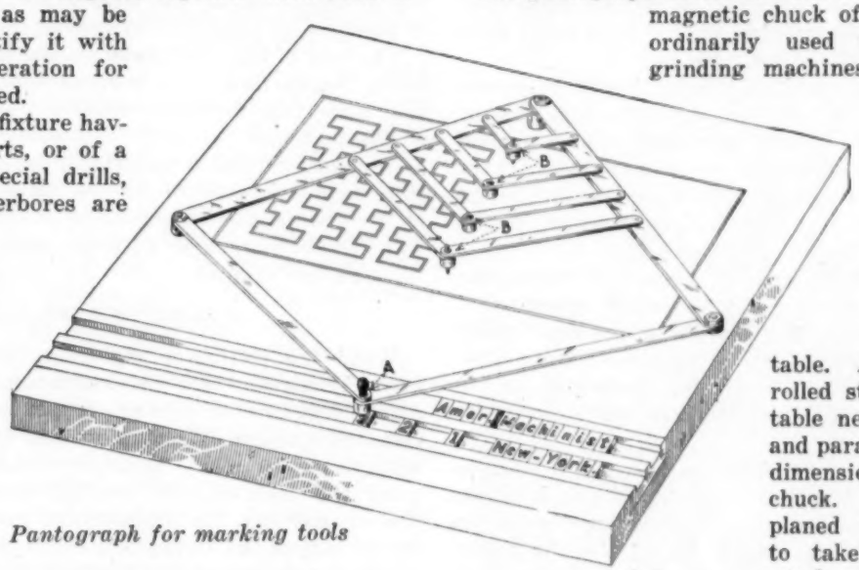
Etching Symbols on Jigs and Fixtures

By Robert B. White

The pantograph and the matrices—Composition of the acid-resisting ground—Wax dam prevents acid from spreading—Acids for etching different metals

JIGS, fixtures and other tools made in the toolroom for service in the manufacturing departments of a plant should be plainly marked with some sort of identifying number or symbol, not only for the purpose of keeping a record of them but to minimize the possibility of mistakes in using them. The practice most commonly followed is to give the tool the name of the part for which it is designed, together with such individual marking as may be necessary to identify it with the particular operation for which it is intended.

In the case of a fixture having detachable parts, or of a jig with which special drills, reamers or counterbores are to be used, it is quite necessary that all of these extra parts should bear the same name, number or symbol as the jig or fixture to which they belong, and also a part symbol of their own under which they may be recorded.



Pantograph for marking tools

Markings almost invariably consist of combinations of letters and figures, since the usual method of making them is by means of commercial steel stamps. If the part is hardened, it is necessary to stamp it at some stage of its construction before hardening, and it is often difficult at such a stage to determine just where and how deep to stamp it in order that a neat and legible marking may remain after the part has been ground.

Then, too, when jigs and fixtures have many related parts, some large and some small, a rather varied assortment of steel stamps is needed, if all the markings are to be in acceptable relative proportion to the space available.

In the toolroom of a large and representative factory of New England, where thousands of tools are made annually for service in the plant, all hardened parts, as well as many that are not hardened, are marked by the etching process after they are otherwise finished. Neither the space occupied by the marking nor its disposition upon the part to be marked need be considered in the making, and nobody need plead that they "forgot" to mark a hardened tool at the proper stage in its evolution.

The paraphernalia employed to do the marking consists of a small home-made pantograph device; a set of matrices, or patterns; a bottle of specially prepared varnish; and sundry small dishes to contain acid, soda-solution, water, etc., necessary to the etching process.

The pantograph device is built around a Taft-Peirce magnetic chuck of the kind and size ordinarily used upon the surface grinding machines of the toolroom. A table of wood surrounds the chuck, a rectangular hole being cut through the wood so that the surface of the chuck is level with that of the table. A flat bar of cold-rolled steel is let into the table near the front edge, and parallel with the longer dimension of the magnetic chuck. In this bar are planed shallow channels to take the matrices, a number of which secured together in the channels constitute the pattern for the designating symbols or letters to be traced upon the jig or fixture.

A swiveling post, secured to the back of the chuck and projecting above its surface, is the fulcrum about which the pantograph frame swings. In addition to swinging about the post in a horizontal plane, a secondary swivel in the post allows the frame to swing in the vertical plane, so that it may be laid back to expose the surface of the chuck, for convenience in arranging the work thereon. The buttons, which form the middle joints of the several levers, are made in the shape of shouldered bushings, with setscrews and adjusting screws to hold and regulate the positions of the stylus and the marking pencil.

The general arrangement of the device may be seen in the sketch, where *A* represents the position of the stylus, and the four joints *B* the possible locations of the marking pencil. The marking pencil is a small steel rod with a diamond set in one end—similar to a truing tool for abrasive wheels—and it can be secured in any one of the four middle joints of the secondary levers, so

that different ratios of reduction in relation to the size of the pattern are obtainable.

The matrices are small obling blocks of bronze, into one face of which the character is engraved. They are made in the toolroom in the following simple manner; the necessary equipment being a bench profiling machine and a set of steel stamps in good condition: A steel stamp, corresponding to the character wanted, is selected and struck into any convenient piece of iron or steel. A rather more than ordinarily deep impression is made, and care is exercised to hold the stamp perpendicularly to the surface, but there is no after work except to smooth off the raised burrs with a file or by rubbing the block upon a piece of abrasive cloth laid over a bench plate. The block is then secured on the table of the profiling machine and becomes the master that guides the cutter in producing the matrix.

The guide-pin is a center-pointed steel rod—hardened, of course—mounted to slide in a holder, and backed by a stiff coil spring. It is prevented from coming out of the holder by a small cross-pin driven through it and through a slightly elongated slot in the holder. The holder is attached to the profiling machine in the ordinary way. A piece of bronze, somewhat larger in size than the finished matrix is to be, is then secured in the vise of the machine.

The cutting is done with a fish-tail cutter of a size and shape to match the stylus used in the free arm of the pantograph. The pointed guide-pin follows around the lines impressed in the master, or guide-block, being held firmly in contact therewith by its spring, while the cutter reproduces the contour of the master in the bronze blank.

The lines in the master are of a sharp V-shape, corresponding to the shape of the steel stamp that impressed them, but the lines in the bronze matrix will appear as wider and flat-bottomed grooves, corresponding to the shape of the cutter that makes them. In size and contour, however, the matrix will be an exact duplicate of the master.

After the character has been cut, the outer dimensions of the bronze blank are brought to size by filing or by other suitable means, so that the width of the blank will be relative to the width of the character; as, for instance, a capital M will require a wide block and a lower-case i a very narrow one. Finishing the outside dimensions of the matrix after the character has been cut, allows any error in placing the character on the blank to be corrected. The character is straightened with reference to the sides of the blank and the bases of all characters are brought to uniform distances from the lower edges, so that a line of letters and figures will present a neat and orderly appearance instead of the ragged and somewhat drunken aspect of the average line of stamped characters.

Having the equipment necessary to make them, additions to the font may be made at any time without appreciable expense. Though any marking consisting of letters and figures might be made with a single alphabet and ten digits, it is much better to have a generous font of the matrices, so that a considerable length of line, or several lines, may be set up and the complete symbol put on in one setup. This saves time and makes a neater job.

To prepare a tool for marking, it is coated with a quick-drying varnish made from the following ingredients: benzol 27 oz., turpentine 8½ oz., rosin 5 oz., and Assyrian asphaltum 8½ ounces. The materials may be obtained in almost any drug store, and any desired quantity of the varnish may be prepared, provided the proportions are maintained.

The liquids are placed together in a bottle somewhat larger than is necessary to hold them and well mixed by shaking. The rosin and the ashphaltum should be pulverized in order to make them more readily soluble. The solids should be placed in the bottle of liquid a little at a time and the mixture vigorously shaken.

Unless one attends strictly to the job, it may take two or three days before the solution is complete. A good way to proceed, is for the one who is preparing the mixture, to place the bottle in plain sight and give it a good shake every time his eye happens to fall upon it. The mixture will keep indefinitely in a well stoppered bottle, but dries with great rapidity when exposed to the air.

The surface of the tool to be marked is brushed lightly with the prepared varnish and the latter allowed to dry, which it will do in a very few seconds. The symbol desired on the tool is then set up by arranging the matrices in proper order in the channels of the bar at the front of the pantograph and locking them in position by means of wedges or quoins.

The tool is then arranged on the magnetic chuck, to bring the surface to be marked into the desired position under the diamond, while the stylus rests in one of the matrices. A little "cut-and-try" may be necessary before getting it just right, but this is easily done. It is well to substitute for the diamond a blunt pencil of wood while the setting up is being done, since there will then be no danger of a premature cut being made through the varnish.

Dam to Hold the Acid

When the setting is right, the switch is closed to turn the current into the magnets of the chuck. The diamond is now set into the proper bushing to give the required amount of reduction, and is adjusted to bear upon the work at the same time that the stylus bears upon the matrix. By tracing the stylus over the line of matrices, the diamond, of course, following the movements of the stylus in reduced proportion, the lines of the characters are cut through the varnish, exposing the bare metal beneath.

The tool is now removed from the chuck and a temporary dam of modeling wax is built around the design, which is now plainly visible. The acid is then flowed on and allowed to act for a few seconds, after which the tool is immersed in a strong solution of sal-soda to neutralize the acid, and washed with clean water.

Nitric acid, diluted to two-thirds or one-half strength with water, is best for steel. Of course, the stronger the acid the quicker will be its action, but there is danger of carrying the eaching too far, resulting in ragged lines. Even the fifty-fifty mixture should do all that is necessary in from one-half to one minute. If copper or its alloys are to be etched, hydrochloric acid should be substituted for the nitric.

A little experience is necessary to get the best results, and one should practice for a while on pieces of scrap before attempting to mark a costly tool. Different steels will require acids of different strengths or longer times of action. This knowledge can be gained only by trial and experience, but the job is not at all difficult, and anyone can soon acquire the knack.

A Machine for Drilling Index Plates

By Milton Wright

AN AUTOMATIC drilling machine for drilling the circles of holes in index plates for dividing heads, is shown in the illustration. The basis of the device is a small bench drilling machine to which the automatic features have been added. The machine is now in constant service in the plant of the Van Norman Machine Tool Company.

The actuating mechanism of the automatic features is a self-contained unit bolted to the top of the frame of the original drill press. A steel worm, running in ball bearings, is connected to the spindle-driving pulley in line with the drill spindle and runs with it. The worm drives a wormwheel upon the hub of which is a pinion meshing with a gear upon a transverse shaft; the shaft thus being driven at greatly reduced speed.

On the end of the transverse shaft the actuating cam is loosely mounted, though it is connected with the shaft through a friction coupling that may be adjusted to slip whenever it meets a predetermined amount of resistance. This constitutes a safety feature.

At the top of the machine a weighted lever, on which is the cam roll, is connected by a reach rod to the feed lever of the drill press, as may be seen in the illustration. The connection is to a modified form of bell crank that replaces the original feed lever. The second member of the bell crank imparts, through an adjustable connection, a reciprocating motion to a mechanism that indexes the work carrier and at the same time withdraws a slide that locates and holds the carrier in position while the drill is at work.

For the work of drilling index plates, a separate work carrier is required for each different number of holes in the various circles. These carriers, which are readily interchangeable, are actually master index plates, each having cut in its periphery a series of 10-deg. beveled notches equal in number to the number of holes to be drilled in any one circle of an index plate. An extra carrier is shown at *A* in the illustration.

The work carrier is so mounted that it can be moved to and from the column of the drill press to correspond with the radii of the various circles of holes to be drilled in the work. This sliding member is provided with a knurled-head, tapered dowel pin to locate it for the different radii, and when set for a given radius it has no further movement during a run.

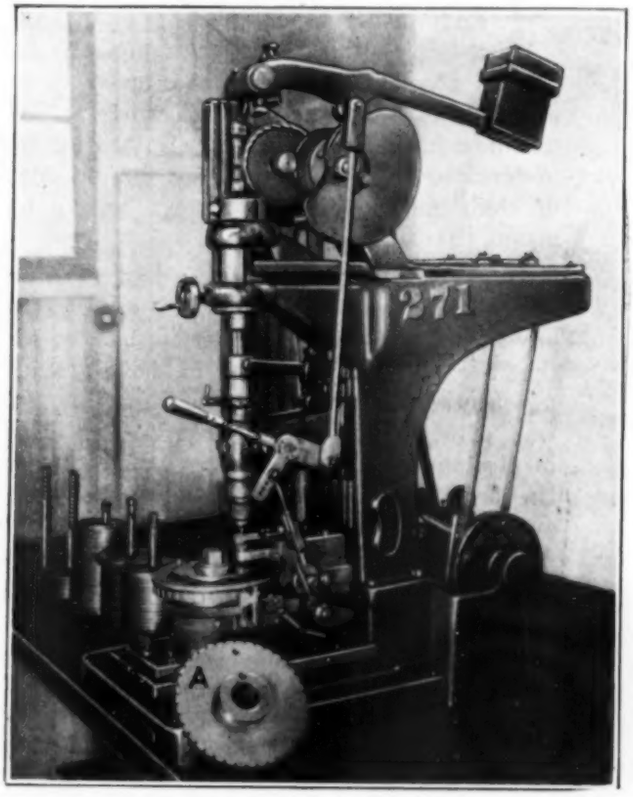
The indexing pawl and the locking slide, though actuated by the same medium, are independent each from the other. The locking slide—called by its designer the "corrector"—is so located as to be almost directlty under the drill, when drilling the outer row of holes in an index plate, and for the remaining circles of lesscr radii it is as nearly in that position as the radius of the particular circle will permit, thus minimizing the possibility of error in spacing. Provision is made to protect the corrector and notches from chips.

The action of the indexing mechanism is first to withdraw the latch, and then to advance the work carrier one notch by means of the pawl. Upon withdrawal, the corrector remains away from the periphery of the carrier until the next notch is reached, when it is shot forward by a stiff coil spring to engage the notch. If, by reason of faulty setting or other cause, the indexing pawl should over-run or under-run its proper distance, the powerful spring behind the corrector, acting in conjunction with the steeply beveled faces of the corrector and notches, would correct the error at once.

In the unit at the top of the machine there is a sliding stop pin so connected by levers and reach rods to the corrector below that it is projected into the path of the cam whenever the corrector is withdrawn from engagement with the notches of the work-carrier. This action takes place regularly at each cycle.

A projection on the back of the cam will engage the stop pin when the drill starts its downward stroke, unleses the stop pin is at that instant withdrawn by the seating of the corrector. Thus, if the carrier should not be moved quite far enough by the pawl to allow the corrector to shoot forward in a normal manner, the cycle movement will be thrown out of action by the cam coming to rest against the stop pin.

Under this condition, the drill spindle, wormwheel and camshaft will continue to revolve, though the cycle



Automatic machine to drill index plates

movement has ceased because of the slippage of the friction coupling above mentioned. This coupling serves a further purpose of safety by being so adjusted that should the drill meet with undue resistance—as from breakage or dullness of the drill point—the cam will stop and thus prevent damage to the work.

Since the locking slide and corrector are concealed by the work and by the overhanging arm that carries the guide bushing for the drill, a pointer in full view of the operator is so attached to the slide that it indicates zero on its scale only when the corrector is properly seated in a notch of the work carrier. Thus, if the machine stops for any reason during a run, the operator is able to see at a glance whether or not the stoppage is due to improper indexing.

THE . FORMAN'S . ROUND . TABLE

Just What Is Discipline?

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared.

"JUST what do you think the Old Man meant about discipline this morning, Ed?" asked Al one evening.

"I couldn't quite make out myself, Al. First I thought he meant that every man ought always to be hard at work at his machine just as a soldier is all attention on inspection. But he's a pretty human sort of chap underneath and I don't believe he meant that at all."

"It's my guess, Ed, that he had in mind seeing that the shop rules were not busted any more often than necessary—that we see that the routine of work and materials are not upset by some chap trying to do things his own way. But there's a lot of difference in ideas of discipline. Some of the boys who were in the army have an idea it means saluting every time the boss passes. But the Old Man probably means less horse-play and less breaking of the rules against smoking and such.

"This horse-play stuff gets my goat," continued Al. "I don't like to be too fussy but I've known so many accidents from what seemed like innocent fooling, that I get uneasy whenever I see it going on. Boys, and even men, don't stop to think what may happen if a man slips and falls against a machine, even if the belts and gears are guarded. It's so darned easy to break an arm, a leg or even a back if something goes a bit wrong that I hate to see it. For no amount of being sorry helps much when a man is laid up or crippled for life."

"Seems to me you worry too much over such things," replied Ed. "Boys will be boys, and you can't stop all their kidding and fooling if you try. And the more you try the more unpopular you get. I don't stand for much of it during working hours, but I get sort of near-sighted when I think they may be fooling out of hours."

"Speaking of 'No Smoking' signs," said Al, "I'd either take 'em down or enforce 'em. If the insurance laws make smoking a menace, as the signs say, it isn't any less dangerous when the boss or a visitor comes through the shop with a cigar than when Bill Jones smokes his pipe. I'd have fewer rules and make them mean what they say if it was my shop."

What did the Old Man mean about discipline?

What precautions can Al take to prevent accidents from men's "fooling" at noon or at other times?

Should Ed get "nearsighted" at times to avoid seeing things he'd rather not know about?

What about rules regarding smoking? Are they reasonable, or necessary and are they enforced or only an ornament on the wall? Do they apply to visitors?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

How Should Suggestions Be Handled?

IN THE first place, no foreman or other shop executive, or for that matter the most lowly laborer, should take credit for another man's ideas. If Scotty knows that his ideas are appreciated and that he will get the credit, he will be a valuable aid to the foreman in many ways, and such fairness on the part of the foreman will breed a feeling of goodfellowship in his department, and a much more satisfied working crew.

His foreman will not lose his job. If the superintendent is fair he will find a job in keeping with Scotty's abilities, perhaps even to replace some other foreman who has no ideas of his own or who steals those of his men. In this day and age of eternal speed a superintendent wants brains with his brawn and so expects and even demands that his workers think.

In a small plant employing a few hundred or less men, the superintendent may easily find time for personal interviews with his men. In general, however, the foreman should first know that Scotty has a suggestion of importance to his department. In a large plant where several thousands are employed, it is well nigh impossible for one man to handle the suggestion situation. There should be a separate department for this, preferably a committee composed of various plant executives. The chairman can then pass on to the superintendent a copy of the approved ones, with the award that was made.—FRANZ D. ABBOTT.

How Should Suggestions Be Handled?

IF THE foreman is sure that Scotty is level-headed, appreciative of his opportunity to "sell" his idea personally and not likely to exaggerate his own importance unduly as a result of his privilege, it is safe to send Scotty to the superintendent. In general though, the workman is apt to be rather long winded and digressive in presenting his idea, and apt to attempt to use his opportunity to grind an old saw, thus using up the more valuable time of the superintendent, either at the expense of the superintendent's duties on other jobs, or else at the expense of the very idea he's trying to "sell," in that the smoke screen he throws up is too dense for the busy superintendent to attempt to pierce.

So the foreman should first separate the wheat from the chaff of the workman's idea, and then present the essentials of the idea to the busy superintendent himself, giving Scotty full credit for his idea. There is absolutely no excuse for his attempting to absorb the credit, for sooner or later, the real source of the idea would be disclosed. No real man, and few get to be superintendent if they are not, would think any the less of his foremen because they encourage the men to think.—JOSEPH KNOX.

How Should Suggestions Be Handled?

ONE of the most satisfactory ways of treating ideas suggested by employees is to distribute to each department foreman a standard form. A Suggestion Committee, holding weekly meetings and comprising five members, pays a cash bonus in proportion to value of suggestion received. This committee is composed of the following: the assistant chief engineer of the drafting department, to act as the leader; the works manager, who will represent the company; the experimental department foreman, representing the shop; the sales manager, and a stenographer, who will act as secretary, whose duty will be to attend all meetings and reply to all suggestions received, either by a note of thanks and check, or a letter explaining reasons for non-acceptance, and to inclose, in either case, a word of encouragement.

The following shows the simplicity of the process by which the employee having a worthy suggestion can deal directly with this committee.

Boxes are installed throughout the factory for a place to deposit these suggestions. Directly before each meeting the contents of these boxes are removed and delivered directly to the assistant chief engineer. As these suggestions are read, the names of the donators are withheld until the idea is approved or rejected. These are then graded by the committee, which issues orders to pay for those of value to the company.—EVERETT H. BRUCE.

Where Shall We Start Apprentices?

I AGREE fully with the thought that it is time to change our system of apprentice training, and begin by giving the embryo machinist some conception of part names, functions and fits.

If we but give him a practical conception of the final product before we train him on the details, we can turn out not only a more interested but a far more practical machinist. And instead of having a man who is speedy at the expense of accuracy, or painfully accurate when accuracy is not essential, we'll have a well-balanced, all-around machinist.—PETER HAGEN.

(Discussion continued on next page)

THE · NEXT · TOPIC

Getting Information from Catalogs

QUESTIONS

What sort of information makes a machinery catalog valuable to a shop man?

Is it possible to get all the necessary information from text books?

What are the functions of a well-prepared catalog?

THE · FOREMAN'S · ROUND · TABLE

How Should Suggestions Be Handled?

I BELIEVE that Al is right in listening to suggestions and in permitting Scotty to see the superintendent to submit his suggestions. Any foreman should be open to ideas and then be big enough to either submit them to the superintendent himself or see to it that the suggestion gets a hearing.

No foreman knows it all and most of them received their positions through making suggestions and improvements in their prior occupations. They should never prevent others from having the same opportunities. A foreman need never fear losing his job because he gets new suggestions from his workmen. He will be a better foreman if his department is continually improved through his readiness to accept suggestions.

A good method for submitting suggestions is to have them addressed to the manager who will assign numbers to them, and who will resubmit them to the foremen for approval. Workmen frequently making good suggestions should be promoted.—WILLIAM BAUMBECK.

Where Shall We Start Apprentices?

IT HAS been our experience that the work a boy may be doing at any one time or where his apprenticeship begins, is much less important in maintaining his interest in his work than the manner in which he is treated and the interest which officials display in his welfare.

The natural progress of an apprentice course is from simpler to more complicated machine work with the assembly operations coming in toward the end of the course. If the apprentice instructor cannot show the boys that even a drill press is an intensely interesting and marvelous machine, there is no use trying to get him interested by taking him into the assembly department at the beginning of his apprenticeship. On the other hand, if the boy has committed a mistake in judgment it is good to take him into the assembly department for a few moments to point out exactly what harmful effect his lack of judgment would bring about. Regarding the necessary knowledge of the product of the corporation and its uses and operation, these can be taught as well in apprentice conferences which are indispensable for other reasons, and by short inspection trips through the erecting shop.

Moreover, bulletins and catalogs can profitably be issued to apprentices from the advertising department as they are published.

Again, if there is a large number of apprentices in the shops as there should be, 10 per cent of the journeyman employment or over, it will not be practical to start every apprentice in the same place and move every one forward according to exactly the same schedule. At the beginning, they must be given such work as they can do but it will not always be on the drill press or on the bolt cutter or anywhere else, because vacancies will not always exist. The more apprentices there are in any organization in proportion to total employment, the more difficult it will be to follow any very definite succession of work. The prime requisite is to have the work progress from simple work to more complicated work and the ideal condition is to finish off with the assembly department. This is the logical procedure and promotion to the assembly department should be held out to the apprentice as something to be striven for.—C. J. FREUND, *Apprentice Supervisor.*

How Should Suggestions Be Handled?

A SQUARE deal is the big idea in modern industrial organizations. For that reason I believe that Al was working along the right line when he sent Scotty to Williams with his idea. While it may be true that the foreman might in some cases be replaced by the man in his department who has money-saving ideas and who can, if given the opportunity, put them into practice, still I do not believe it happens very often.

The foreman who is looking for promotion should always have a good understudy ready to take his place, and how can he do this better than by sending Scotty to Williams with a good idea? Scotty should be well paid for his idea and his foreman should receive proper recognition for having developed such a man in his department.

I do not believe that Al is in danger of losing his job to Scotty, but I believe that his standing with his company is made stronger and his promotion more certain through the action which he took. Scotty should be encouraged to give the company his ideas since it would make for a good feeling in the department and induce others to follow his example. Nothing encourages a man quite so much as a little extra cash in his pay envelope. While it is true that the company has a right to expect to profit from the workman's idea if it is developed during his regular working hours, still I believe that when the company actually profits through the application of the idea, the one who gave the idea should be compensated for it.

If Williams is man enough to give Scotty his time and go over his idea with him, he will be big enough to favor the idea of a foremen's meeting. He should favor a foremen's meeting because:

(1) It will create a feeling of goodfellowship among all concerned.

(2) It will bring out for development ideas that otherwise might never be advanced.

(3) It will bring a group of men together who come from all departments of the works and will enable them to discuss their problems and suggest ways and means for solving them.

(4) Unity of thought and action always produces results.

In the matter of suggestions, I think they should always come to the management through the foreman. The foreman is held directly responsible for all that takes place in his department and I think that the morale in the department will be better where such matters are taken up with the superintendent through the foreman.

There are many ways of looking at the question as to whether the old superintendent was right in not

THE · FOREMAN'S · ROUND · TABLE

dealing directly with the men. When a suggestion is the matter under discussion, I think it should always come up through the foreman. The management beleives that its foremen are competent, honest men else they would not be foremen.—FRANK A. HYDE.

Where Shall We Start Apprentices?

AL IS WRONG if he thinks that a new apprentice can go right in and assemble machinery. Of course he might put rivets into punch press parts or screws into die castings, but Al talks about where every piece goes and the difference between loose fits and good fits. The green apprentice will probably get rattling good fits and fits from the "Super" unless the assembler tells the apprentice to put that piece down before he gets more vise marks in it.

It must be remembered that you are training a boy whose chum Tom goes to work at 8:45 and just beats the boss in, and whose chum Jim makes the delivery truck "hump," so that he can get in an hour or two of playing ball, while the most that the apprentice can do is to sneak a smoke and then the old man smells it.

You must inspire him with that creative spirit of making something right and fast, which puts us as a nation so far ahead of the rest of the world. You must prevent his having an "inferiority complex" because of spoiled work and "call downs," and you must tie him to you and to the company with bonds of friendship. And you can't do it by making him chase tools, wash chips off into the soda tank or killing time until you get around to him.

He must be given a real job and enough parts of a kind, so that he can make sure of himself, enough variety to keep him awake, and enough vision of one day getting to the toolroom, the assembly floor or out on the road.—ROBERT B. MCLAUGHLIN.

Where Shall We Start Apprentices?

BACK in 1894-98 when Wm. Cramp & Sons Ship & Engine Building Co. was helping Uncle Sam build up our navy and the government paid $25,000 for every ¼ knot above the contract speed, I had the pleasure of serving my apprenticeship with that company.

In those days the greatest care was taken in the erecting of the engines so as to maintain the best possible speed on their trial trips in order to gain the largest bonus possible. In order to attain this speed the company put the best mechanics obtainable on the job.

The gang foreman had to be a marine engineer and run the engines on the trip. The machinists, who were first-class men, were used as oilers and water tenders. The firemen were first-class machinists' helpers. I am summing up this bit of history to show the methods of that time.

We apprentice boys served two years out on the ships assembling the parts as they came from the shops, and our final two years was spent learning to run the machines in the shop. I heartily approve of this plan where possible. It was a wonderful help to me.

When we went in the shops after those first two years of experience in assembling, we not only learned the names of the parts but we knew how they should fit and what happened if the fit was not right. The boys were graded according to their ability as they advanced. When they did a good job at drilling they would get a better one next time, fitting and scraping in valves, assisting in the lining up of engines, and so forth.

Each boy was put under the sharp eye of a first-class machinist and this man was responsible for that boy's work, so you can readily see what an advantage the boys had when they advanced to the machine shop to finish their last two years.

Since the boys were advanced from one machine to another about every three months, the job was always interesting. The methods used by this company made my apprenticeship a real pleasure to me.

—J. HOWARD STUDHOLME, *Master Mechanic.*

Where Shall We Start Apprentices?

THE more I think about it the more I agree with Al, whose idea is to start the apprentice on assembling work. I agree with him because I've seen it tried, and it worked. We'll admit that a solid foundation and background are absolutely essential, but most all of us can tackle the foundation with a lot more enthusiasm after we've seen what is to be put upon it.

I've seen some very good mechanics in the erecting department who couldn't ever call themselves machinists, but any of them could be trained into better machinists for the experience that they have had on the floor. Of course, a fellow can develop into a good machinist without going onto the erecting floor, but he's much more likely to be what I'd call a good blueprint machinist—makes it so because the drawing says so, not because he can also visualize it.

It is also a help to the apprentice to be given a little time in the testing department. It helps a lot when the apprentice can see what the machines are supposed to do after they have been put together. And when a bearing runs hot or some part was not lined up just right, it gives a fellow an idea as to why certain limits must be held to, and why any old thing won't go, just because his boss said it wouldn't.—GRANDON D. GATES.

Keeping Machines on the Job

BY TEACHING the men in his department to be on the alert and report needed repairs, the department foreman is constantly in touch with the condition of his department. The repair foreman is responsible for repairs only after he has received orders from the department foreman. His authority ends with the repair force. An order system ends all disputes and places all responsibilities. The authority of the department foreman is his order pad.

Allowing a machine tool equipment to drive until it fails is identical to sitting blissfully at the steering wheel until the vacuum tank fails to deliver gas.

—STORRS T. RICHMOND, *Master Mechanic.*

Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

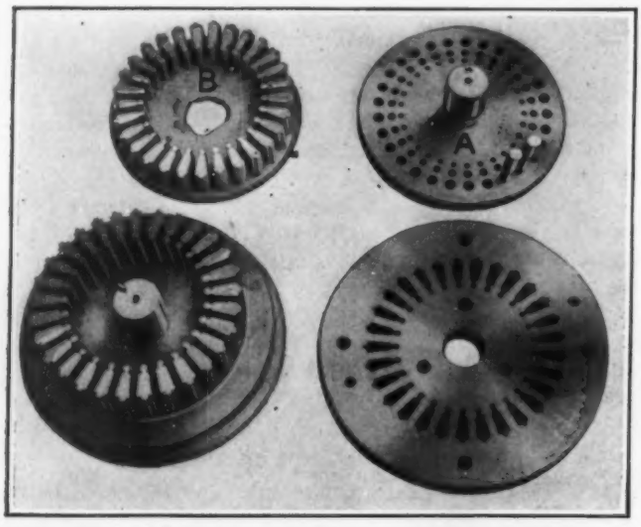
Fitting Dies and Punches for Rotor Laminations

BY HENRY DENSMORE

The usual method of making a die and punch for piercing or blanking sheet metal is to make the die to a templet, harden it, and shear the soft punches into the hardened die. In the tools shown in the accompanying illustration the reverse process is employed. The punch, which is made in sections, is finished complete, hardened and tempered, and is ready to go into the press before the die is even started.

The individual punches—hardened, and ground to gage—are fitted into the notches of a central spider, which is also hardened and ground, and are retained therein by shrinking a ring over them. The rear ends of the small punches are flush with the surface of the spider, and are covered by a back plate to which each punch is secured by a screw to prevent it from being pulled out when in service.

The die starts as a flat disk of steel having a central



Punch and die, drill jig, and sulphur cast

hole into which fits the round punch in the middle of the other tool. The drilling jig *A* is clamped to the die-blank, being centered by the plug in the middle, and all holes are drilled. The jig is then removed and the webs between the drilled holes are cut out in the usual manner. The punch is then set over the die and placed in a screw or hydraulic press and the impression of the individual punches squeezed into the soft metal of the die.

The first impression is made just deep enough to show a clear outline of all the punches. The die is then filed to the lines on a filing machine. The shearing process is repeated often enough to insure a close fit for the punches all the way through the die. There is practically no clearance—not more than one-half thousandth being allowed on a die $\frac{7}{8}$ in. thick.

A somewhat unusual method is employed to inspect and record each die as it is made. The die is inverted on a flat surface, encircled by a piece of strip stock that is bound in place with a wire, and the mold thus formed is poured full of molten sulphur.

The well-known property of sulphur that allows the cast to retain its size and shape without shrinking and with every corner and angle sharply outlined renders it invaluable for this purpose. The least back-draft in a die would prevent the removal of the cast intact. The cast is, of course, an exact duplicate of the punch and can be compared with the latter at all points by the use of a micrometer. The cast is shown at *B*.

The dies and punches are made of a non-shrinkable high-speed steel, and the fact that the punch, fitted to an unhardened die, will enter the same die after the latter is hardened, emphasizes the non-shrinking qualities of the steel. The material to be cut is 0.021-in. gage. This method is followed by the Westinghouse Electric & Manufacturing Co. at its East Springfield plant in making tools to cut small laminations for motors.

Cutting a Special Wormwheel

BY JOS. E. ABBAZIA

A badly worn wormwheel was recently sent to us with an order to make one like it. Since the worm was not sent with the wheel we had the problem of finding the shape of the tool with which to cut the hob. Ordinarily there would have been no difficulty, but the wheel sent us had only 18 teeth and must have been cut with a hob of special form, because the teeth were not undercut at the flanks. It is well known that wormwheels having less than 30 teeth, cut with standard hobs, have teeth undercut at the flanks.

There were five teeth in fairly good condition, so that we were able to determine the diameter of the worm by turning a piece of steel to fit the throat and by measuring the depth of the teeth. We then made a worm blank of lead and cut threads on it of the approximate shape and depth. The lead worm was mounted on the arbor of a milling machine. The old wormwheel was put on a mandrel placed between the index centers so as to allow it to revolve freely. With the thread of the lead worm in mesh with the five good teeth of the wheel, the milling machine spindle was revolved. At the same

time the table was raised slowly, with the result that the worm was forced into the wheel until its thread fit the teeth. In this condition the worm was used as a gage for making the tool with which to cut and relieve the hob.

After completing the hob, the wheel was gashed and hobbed in the usual way.

Press Tools for Making Steel Ferrules

By John Strama

The group of dies in Figs. 1 to 6 represent press tools for the development of a ferrule from a plain strip of 0.020 cold-rolled steel, to the finished article. The line drawings show the construction of the tools. The operations are performed in the following sequence: Cutting and drawing, trimming, flanging, slotting, and curling, as being the most rational.

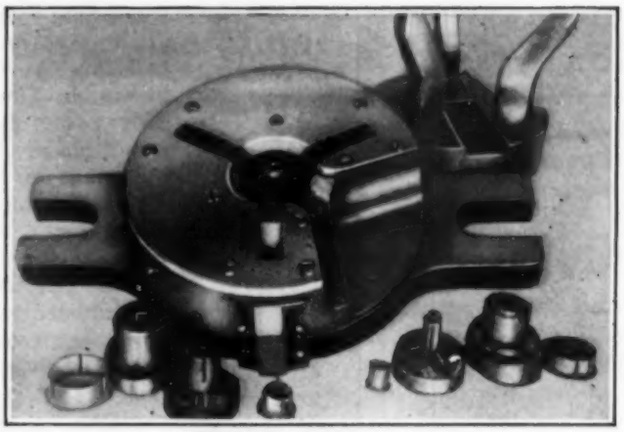


Fig. 4—Slotting tools

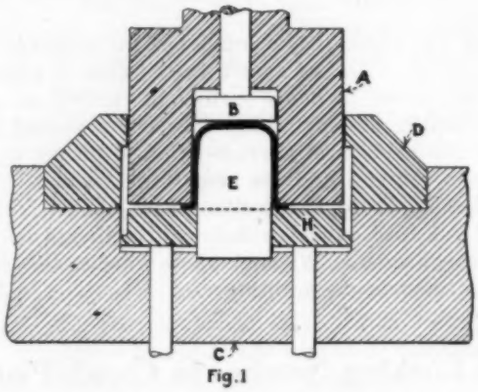


Fig. 1

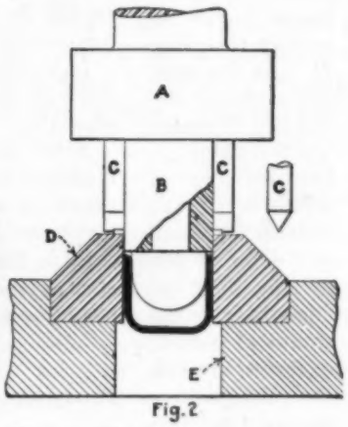


Fig. 2

Fig. 1—Cutting and drawing tools. Fig. 2—Trimming tools

The cutting and drawing tools are shown in Fig. 1. The upper member consists of the punch *A*, and the stripper pin *B*. The lower member or die consists of the shoe *C*, into which the cutting ring *D* is pressed, the drawing post *E*, the pressure pad *H*, with pins and spring attachment, and the stripper plate. The spring attachment and the stripper plate are not shown. This tool cuts the blank out of the strip and draws it over the post *E*, leaving a flange for trimming.

The second-operation tools, Fig. 2, trim the flange as shown. The upper member consists of the punch holder *A*, the trimming punch *B*, two scrap cutters *C*, and the trimming ring *D*, which is pressed in the shoe *E*.

The third-operation, or flanging tools are shown in Fig. 3. They consist of the punch holder *A*, the piercing-punch *B*, the flanging tool *C*, the stripper attachment *D*, the piercing die *E*, and the flanging ring *H*, the latter being mounted upon the shoe *J*.

In operation, the piece, after the first and second operations have been performed, is placed in the flanging ring, Fig. 3. As the ram descends, the bottom of the piece is forced down upon the cutting edge of the tool *E*, piercing the hole. As the downward motion of the ram continues, the flanging tool *C*, being forced against the bottom of the punch holder, forms the flange and at the same time forces the metal against the smaller portion of the punch at *B*, which acts as a knockout to raise the work out of the die on the up stroke, since the hole is smaller than the end of the punch. Continuation of the up stroke of the ram actuates the stripper *D*, stripping the piece from the punch and curling the metal toward the wall of the ferrule.

The fourth-operation, or slotting tools are shown in Figs. 4 and 5. In Fig. 4 the complete die is shown in one view, while Fig. 5 shows a partial section. These tools consist of the shoe *A*, the three sliding jaws *B*, the slotting punches *C*, the retaining plate *D*, the slotting die *E*, the punch holder *H* and the cams *J*.

In operation, the ferrule is slipped over the slotting die *E*. As the ram descends, the three cams enter the openings in the jaws, forcing the slotting punches toward the center and cutting the slots in the ferrule. On the up stroke of the ram, the cams draw the punches out of the ferrule and it can then be removed from the die.

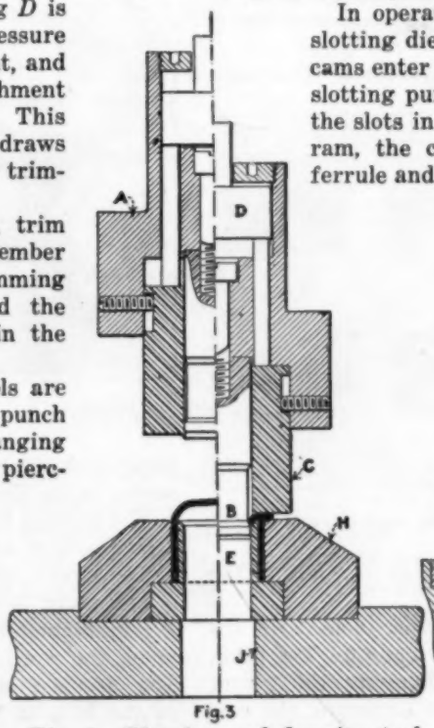


Fig. 3

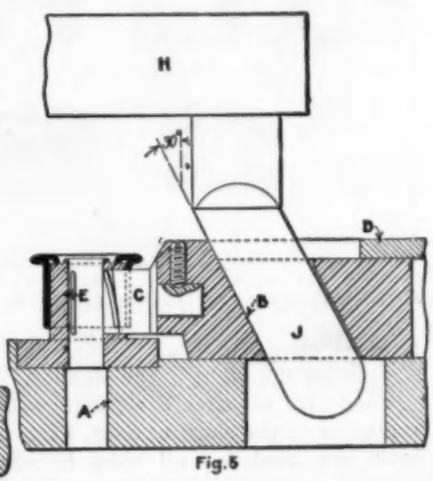


Fig. 5

Fig. 3—Piercing and flanging tools. Fig. 5—Slotting tools in section

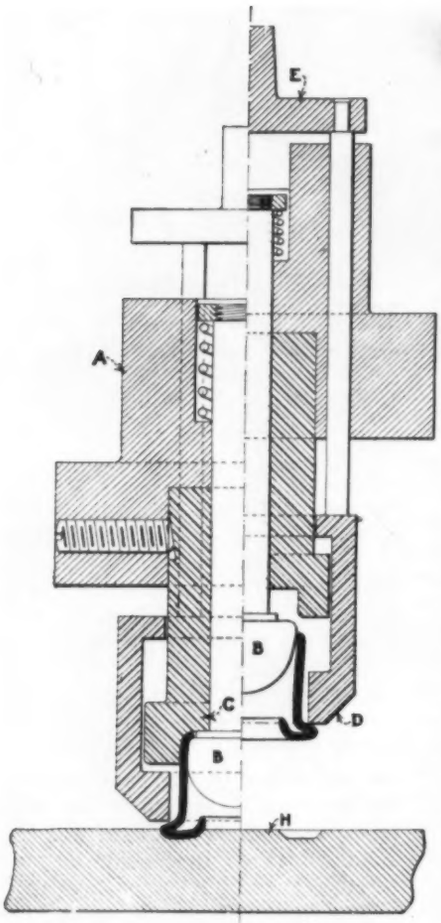


Fig. 6—Curling tools

The final-operation, or curling tools are shown in Fig. 6. They consist of the punch holder *A*, the sizing pin *B*, the curling punch *C*, stripper *D*, the stripper pins *E*, and the plate *H*. The illustration shows the tools in both the open and the closed positions.

In operation, the ferrule is placed in the recess in the plate *H*. As the ram descends, the sizing pin *B* enters the ferrule, while the member *C* slides over the outside. The upper edge of the ferrule, upon being struck by the radius of part *C*, is forced inward. On the return stroke, the ferrule rises with the punch until the stripper *D* forces it over the larger part of the pin *B*, which is slightly larger than the inside of the ferrule before curling, opening the curled edge as shown at *A*, Fig. 7. As the press still continues its up stroke the member *D* forces the piece off the pin, allowing it to drop out of the punch.

Ferrules of this type are manufactured in several

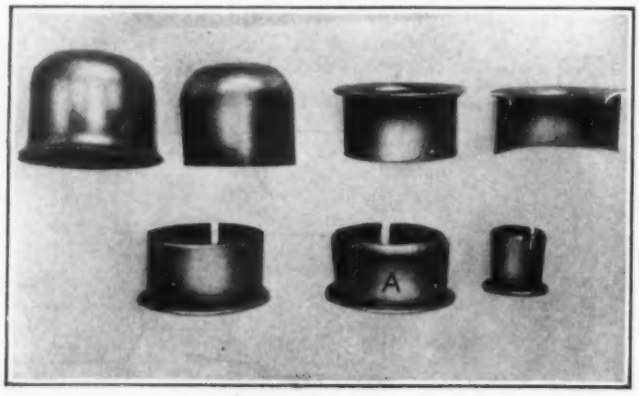


Fig. 7—Ferrules of various sizes and in different stages

sizes as shown in Fig. 7. The one on the left is the largest, on the right is the smallest.

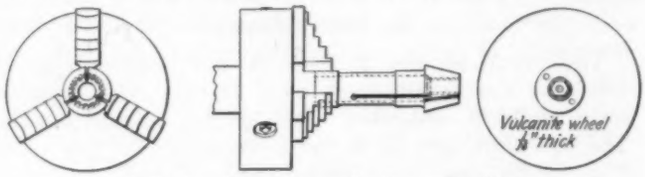
Each size requires a separate set of tools, with the exception of the slotting tools, Figs. 4 and 5. The other tools are used for all sizes by changing the center piece *E* to the required size, and by adjusting the ram of the press.

Making Spring Collets

By L. A. Inscoe

Wolverhampton, England

To the uninitiated, the job of making spring collets appears to be a very simple one. However, a pitfall awaits the one who cuts the spring slots entirely through to the hole before the hardening operation. In turning and boring the collets, sufficient allowance



Cutting the slot webs by grinding

should be made for grinding after the hardening and tempering.

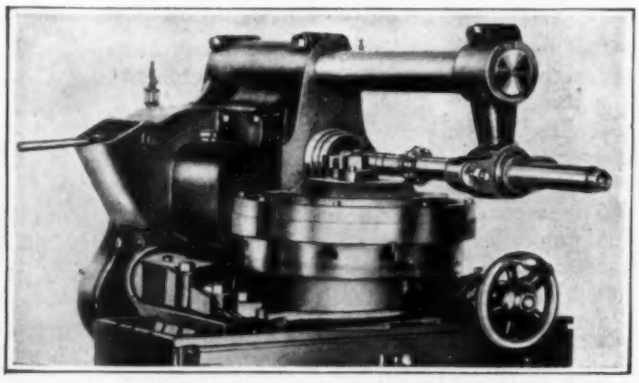
In cutting the slots, they should not go through to the hole by about 1/8 in., as shown in the sketch, otherwise the collet would be badly sprung in hardening.

After hardening and grinding, the collets should be mounted in the horizontal surface-grinder, either in a chuck or upon centers, and the remaining webs of the slots cut through by a vulcanite wheel about 1/8 in. thick. The vulcanite wheel will cut through hardened steel without burning. Without such wheels, the job would be the toolmaker's nightmare.

Hobbing Locking Notches in Clutch-Plate Adjusting Rings

By Herbert C. Everett

Formerly the locking notches in our clutch-plate adjusting rings were cut with a single cutter, the work being indexed from notch to notch. Need for greater



Fixture for hobbing clutch-plate adjusting rings

production forced us to adopt the hobbing method, as shown in the illustration.

The holding fixture is mounted on the circular milling attachment of an 18-in. plain Cincinnati milling machine of the knee type.

The work is located by being placed over a pilot of 10½ in. diameter and rests on the finished backface. To bring the work to the hob, the knee is raised by hand. The circular table is revolved in unison with the lead of the hob, in the same manner as in hobbing gears. The production is one piece in 6.15 minutes.

Characteristics of Ampco Metal

Ampco is a copper-aluminum alloy containing an appreciable percentage of iron. It is on the market in a large variety of sizes and shapes, and is commercially employed for bearings, packing, gears, worms, universal joint segments, and for other uses where a tough metal is required. It is resistant to the action of acids and alkalies, and is recommended by the makers for use in parts subject to the action of chemicals or superheated steam. The metal is also a good conductor of heat and electricity, and is claimed to be non-magnetic.

Nature of the Alloy

The alloy has an approximate analysis of 80 to 88 per cent copper, 7 to 10 per cent aluminum, and 5 to 10 per cent iron. Its composition is free from tin, zinc, lead and phosphorous. Its color is a golden yellow, and the metal will take a high polish.

Ampco metal is made in 10 grades ranging from No. 8, the softest, to No. 22, the hardest. The weight of the metal averages 3 per cent less than steel, and 15 to 20 per cent less than bronze. The scleroscope hardness ranges from 15 to 55. The average physical properties of the different grades can be judged from the accompanying table. The softest grade is employed where a soft bronze is required. Grade 12 is used for high-speed bearings in connection with mild steel. Grade 16 is recommended for bearings, bushings, gears, or any parts where toughness and resistance to wear are required. The grade 18 alloy is resistant to ordinary chemical action, is tough, and has high strength. It is used for valves and fittings, pickling equipment, chemical apparatus, and machine parts subject to pressure. On account of its hardness it is used only with high carbon or heat-treated steel. Grade 22 is used where a very hard and tough metal is needed. This grade is difficult to machine.

Ampco alloy is commercially on the market in the form of bars, ingots, castings, and bushings. Solid bars are furnished in stock sizes from $\frac{1}{4}$ in. to 4 in. in diameter, and cored bars from 1 in. x $\frac{1}{2}$-in. hole to 4 in. x 3-in. hole. Bushing stock is furnished in 12-in. lengths in sizes up to 7-in. outside diameter and 5-in. hole. Sand castings are supplied in sizes up to 1,000 lb. each. In specifying cored bars for bushings, an allowance is made for the removal of $\frac{1}{8}$ in. of metal in machining.

Machining

The machining of Ampco metal, in all but the highest grade, is accomplished readily with any good high-speed steel tool sharpened as for the cutting of cold-rolled steel. Cutting speeds up to 55 ft. per min. are used. Bearings made of the alloy should be reamed, as irregular spots do not wear down readily. Bearings made of Ampco metal are claimed to give a wearing life 5 times greater than ordinary bronze.

Speeds and feeds employed in machining the soft and medium grades of Ampco metal are similar to those used on cold-rolled steel. The hardest grade of the alloy is not commercially machinable.

The nose of the tool used for turning Ampco metal should be ground to a blunt point, and the sides should have an angle of from 25 to 35 deg. A top rake is not required on the tool. An end clearance of 10 to 12 deg., and a side clearance of 4 to 6 deg. will ordinarily give good results. Drills, reamers and cutters are ground the same as for cutting mild steel.

The alloy can be cast, forged, rolled, and drawn. The melting point is between 1,850 and 1,950 deg. F., but a temperature of 2,000 deg. F. is recommended for ordinary casting, and 2,200 deg. F. for the casting of thin sections. Rods $\frac{3}{4}$ in. in diameter, and 15 ft. long are cast successfully at this temperature. The casting of Ampco metal is done in sand molds having gates and risers similar to those used for casting steel. The risers are placed at the heaviest parts of the casting, and the gates at the lowest. The molten metal is fluxed with rock salt. An allowance of $\frac{1}{4}$ in. to the foot is made for shrinkage of the castings. Pickling and sand blastings are not required, since the castings can be produced smooth and free from scale.

Forging and Welding

For hand-forging, the metal is heated to a temperature of 1,200 deg. F., and for drop forging a temperature of 1,350 deg. F. is used. Dies for drop forging are made according to standard design of a good quality of die steel. The annealing of Ampco metal is done by heating to 1,650 deg. F., and then allowing the pieces to cool gradually. The softer grades may be hardened by quenching in water from the same temperature.

Table of Average Physical Properties

Grade	No. 8	No. 12	No. 16	No. 18	No. 22
Yield point lb. per sq.in.	20,000	25,000	35,000	40,000	45,000
Tensile strength lb. per sq.in.	50,000	65,000	75,000	85,000	100,000
Elongation in 2 in. per cent	50	25	20	12	4
Reduction of area, per cent	38	25	18	8	..

Welding of the metal is done either by the acetylene or electric processes. Large parts can be welded more readily if preheated up to a temperature of about 1,700 deg. F. Welding rods of the same metal are used, and no flux is needed. Electric butt welding is readily accomplished on Ampco metal parts.

For the information given we are indebted to the American Metal Products Co.

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Sherardizing Iron Articles

Q. Can you print in the American Machinist *a brief description of the process known as "sherardizing?"*

A. Sherardizing was developed by Sherard Cowper-Coles about the year 1900. The process consists of applying a coating of zinc to iron or steel by tumbling the articles in zinc dust.

The articles to be sherardized are first cleaned and pickled, or sandblasted. They are then packed in drums filled with zinc dust and rotated at slow speed for 3 or 4 hours in a furnace at a temperature of 650 to 750 deg. F. The zinc does not alloy with the iron, nor does it form a coating of pure zinc as in the hot dipping process. The zinc actually combines with the iron and forms $FeZn_3$ on the inside and $FeZn_7$ on the outside of the coating. The outer surface is rough and porous, but the character and thickness of the coating can be regulated considerably by varying the temperature, time of exposure, and quality of zinc. A small amount of iron dust may also be added to the zinc. A sherardized coating can be varied from 0.0015 to 0.008 inch.

Pickling Old Files

Q. We understand that there is a method of recutting old files by using an acid formula. Can you inform us regarding this process?

A. The machine shop "kink" of pickling a file in an acid bath is an old one, but it is seldom employed since it is not very effective. An ordinary pickling bath of a weak solution of sulphuric acid is used. The chief benefit is in the thorough cleaning given to the file by the bath, but it is also claimed that the acid renews somewhat the cutting edges of the file. Before dipping in the acid the files are cleaned in a hot potash solution, and after pickling they are washed thoroughly.

Plating the Working Surfaces of Gages

Q. Have you any data that would be useful on the subject of plating the working surfaces of gages with chromium?

A. We understand that experiments are being conducted on the chromium plating of gages to resist wear, but so far nothing has developed commercially. We believe that considering the results obtained on intaglio printing plates at the Bureau of Engraving and Printing, chromium plating can be applied successfully to gage making.

Intaglio plates were formerly made of steel and case hardened, but they did not last long under the severe abrasion from continual polishing after each printing impression. They are now plated with chromium, the plate being not more than 0.0002 in. in thickness, and scratch hardness tests show that the surface of the plate is considerably harder than the hardest steel.

Since these intaglio plates have a highly polished surface free from the least mar that would catch ink, and since the constant wiping between impressions is similar to the nature of the wear on a gage, we are inclined to feel that experiments will indicate great possibilities for chromium plating on gages. Beside the initial advantage from the longer wearing life of the surface the chromium plate can be "stripped" off after it is worn, and a new surface deposited.

Lubricant for Copper Milling

Q. Can you recommend a lubricant for use on cutters for milling and slotting copper?

A. Try ordinary white lead mixed as a heavy paste and applied to the cutter with a brush. White lead has been found to be a satisfactory lubricant for sawing deep slots in copper since it helps to break up the chips as well as lubricating the cut.

Size of Loose Pulleys

Q. How much smaller than the tight pulley should a loose pulley be made?

A. In his studies on this subject some years ago Carl G. Barth advocated making the loose pulley one inch smaller in diameter than the tight pulley to cover all average cases. The purpose is to relieve the tension of the belt when it is not under a load. The loose pulley was also made with a short steep bevel on one side in order to assist in shifting the belt.

Tinning Iron Castings—Discussion

BY F. DEVINE

While your recommendation on zinc coating in place of tin on page 180, Vol. 65 of the *American Machinist*, is undoubtedly correct for general work, it may be that the inquirer is building machines to handle edible products and must stick to a tin dip for the parts.

The castings can be coated satisfactorily with tin by the following method: They should be first pickled in a weak solution of sulphuric acid and then sand blasted, after which they should again be dipped in an acid bath. Both acid baths should be heated to a temperature of about 100 deg. F. After cleaning in the second acid bath the parts should be washed thoroughly in hot water.

The next process is to dip in a well heated bath of palm oil to drive of all water and to coat with the grease as a flux. From the grease pot the parts are dipped directly in a highly heated tin bath, and then dipped into a second tin bath at a lower temperature. The second tin bath is called a "wash pot," and is intended to give the parts a more even coating of tin. Two wash pots may be used, and the parts given a rapid brushing between the two dippings in order to clear off any rough spots in the coating.

Technical Abstracts

To Make a Business Grow—Begin Growing Men!

Careful hiring, thorough training, fair supervising, just promoting and discharge as a last resort only, will result in reduced labor turnover, one of the heaviest expenses in a business. This being an age of specialists, when a man is promoted to an executive position, he must learn that there are other branches of the business quite as important as his own. The International Business Machines Corporation has always held schools, each executive teaching the men under him. Later the problem of how to teach the executives arose. It was solved by the executives' school which included all those exercising authority down to and including foremen. The basic policy of the company was set forth: to manufacture better goods for less money in order to sell more goods at a lower cost. Suggestions from every one present as to the best ways to attain this end were sought.—Thomas J. Watson in *System*, August, 1926, p. 151.

Rate Setting

Two misconceptions are far too generally believed in regard to elementary time setting and rate setting; first, that time setting must be made as a specific job; and, second, that time setting is an adequate and suitable means of determining cutting speeds and feeds. It is amazing that anyone should think of determining correct cuttiny speeds other than by the use of Barth's slide rules, which may be regarded as a solution to the problem.

Taylor had constantly in mind the making of elementary time setting of the work performed by a man in such a manner that it could be used to determine the time required to accomplish jobs other than those in connection with which the studies were made. The object was to be able to compile instruction cards from a relatively small number of basic studies and to compute the time required for practically any and all jobs that could be done wth the shop equipment. In a plant where machinery, tools, and conditions generally have been standardized and where studies have been made and the results tabulated, and where Barth's slide rules have been provided to take care of the question of speeds and feeds, it should be an easy matter for a qualified man to write out a detailed instruction card from a blueprint of the part, provided the work is reduced to a series of elementary steps. As an example, instruction cards of the same job were prepared in the planning departments of two widely separated plants, and the results in time were found to be practically identical.—H. K. Hathaway in *Manufacturing Industries*, August, 1926, p. 125.

Are Statistics Stabilizing Business?

Much of the available statistical data must be ignored as irrelevant by the student of a particular business. Progress toward stabilization is being made by many business men who are insisting on getting facts before they shape their policies. The Walworth Co. has worked out an index that shows the trend of general ordering demand as well as the ordering for valves and fittings. The wide fluctuations of the curve obtained by plotting this index, so evident in 1919 and 1920, have flattened out very considerably in 1925 and 1926. Apparently the "fits and starts' method of conducting business formerly in vogue is yielding to a more thorough and orderly system. One of the greatest benefits obtained is the stabilization of employment made possible.—Joseph H. Barber in *The Management Review*, August, 1926, p. 231.

Oil-Fuel Burning Systems

The benefits of oil firing for marine service are found in decreased time in bunkering, greater cleanliness, smaller space required, and greater steaming radius, but the use of oil for land boilers has usually not been found financially advisable.

There are other considerations, however, which should have weight when considering oil firing. An advantage of oil fuel is its flexibility under fluctuating load. With oil the flame can be adjusted immediately to suit the load conditions. Cleanliness is an important factor for industrial heating, and with oil fuel dust is eliminated.

A feature of particular value at the present time is the use of oil as a stand-by in a coal-fired plant. The installation of an oil-burning system is not an elaborate undertaking, and what is known as mixed firing is frequently an advantageous proposition. This consists of supplementing a coal fire by one or more oil jets operating in the same furnace. These oil jets take care of the major loads, and sometimes allow a lower grade of coal to be burned. The fitting of an oil-burning system to a coal-fired boiler can be quite a simple matter. In applying such a scheme to a Lancashire boiler the fire grate is removed and a single burner is fixed in the center of a plate bolted to the furnace front. This is frequently carried without any brick work.—*Mechanical World* (Manchester, England), Aug. 6, p. 103.

Only the Best Equipment Pays

The comments of foreign visitors regarding their amazement at the modern equipment in American plants, has commanded considerable attention. Some of the points brought out were that the average American workman has 3½ hp. of electrically energy at his elbow and that the machines provided for him are of the latest models.

However, engineers familiar with conditions in metal-working industries realize that a vast amount of obsolete equipment is still in service. Since the depression of 1920, machine tool builders have devoted a great deal of effort in improving their products.

Manufacturers who have had the courage to install the latest types of equipment, have been enabled to decrease the cost of their products. Those who cling to obsolete equipment, find themselves at a serious disadvantage when competing with more enterprising concerns.—Howard Rowland in *Iron Trade Review*, August 5, 1926, p. 311.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

New Steels and New Speeds

WONDERS are being accomplished with the new alloy steels containing small percentages of the rarer metals that give the alloy higher properties. Steels with greater wearing qualities and resistance to corrosion and to heat have been developed commercially. Now Sir Robert Hadfield has announced another steel alloy that can be made into bearing parts that will run when red hot. It is claimed that the Hadfield plant is building a gas turbine capable of running at 55,000 r.p.m. at a temperature of 1,650 deg. Fahrenheit.

This matter of special steels may be a road to the solution of our internal grinding speed problem. Manufacturers of internal grinders for small holes face the fact that they can safely recommend grinding spindle speeds only about half what the users demand. They claim that the ball bearings as now made commercially will not give a satisfactory life when subject to extremely high speeds. It seems to be up to the makers of ball bearings to find a metal that will hold up at these high speeds. Ball bearings may never be called upon to run red hot like the gas turbine, but if the designs cannot be changed to decrease wear, possibly steels can be found that will stand the speeds.

Too Many Specifications

SPECIFICATIONS may be either a help or a hindrance. If they aid in securing a better product without too great an addition in price, they have probably served a useful purpose. If, however, they are drawn by men without a broad knowledge of the subject, they cause delay, increase cost and result in the buyer securing an inferior article.

In the case of a standard product, specifications can well be confined to performance, with as few limitations of size and weight as circumstances will permit. Performance, which includes durability over a given period, permits the maker to supply the best machine available. A recent case, where close specifications were drawn by men who knew only their own equipment, resulted in awarding the contract to a machine that had been obsolete for about two years.

Competitors relying on the manufacturer to supply the latest design profited by his experience and are receiving the benefits of the more efficient machines, while the buyer who wanted to be sure that the maker did not put anything over on him is two years behind the times.

Detailed specifications may be desirable where the buyer is also the designer of the product to be made. But where the builder has had more experience than the buyer, it is far safer to specify performance, and little else.

Bucking the New Management

AGE may be either an asset or a liability, in individuals, in commercial organizations and in nations, although the latter, of course, depend entirely on the first two. If age can use its experience to aid the ever changing practices of business, it is an asset. When, however, it attempts to block changes, either from the "arrogance of age" or because it cannot see how old practice can ever be improved, it is a very serious liability.

This is one of the problems that almost every manager of an old plant is up against. Some of the old men who have weathered the storms of several reorganizations, refuse to change their ways, compelling the new manager to discharge or pension them, or else admit that he is not the manager. This, in many cases is behind the charges of ruthless discharge of old employees.

In nearly every instance a man who will try to co-operate with the new management need have few worries as to discharge. Whether he agrees with the policies or not, he must see that the new manager was hired to make changes, not to continue in the old way. And the new manager must manage, or quit.

Bad Order Machine—Poor Work

WRONG impressions are very easily obtained. In fact, it is difficult to avoid them unless we follow up the source of information and learn some of the details connected with it.

Seeing a lot of hand work in a shop recently we inquired as to the possibility of doing it on a machine. The answer was that no machine of the type could produce work sufficiently accurate for the purpose.

Inquiry revealed the fact that the only experience with that type of machine was confined to one of ancient vintage that had seen hard service and had never been overhauled. While the informant was thoroughly honest in his belief, his lack of experience made his statement entirely misleading.

If a standard machine is not producing accurate work it is wiser to examine its condition than to get the idea that hand work is necessary to secure accuracy.

Coolants as Aids to Cutting Tools

By Sydney French

High speed stock removal always requires coolants—Effects of heating—Qualities of coolants—Dangers of separation of ingredients

INASMUCH as a fundamental basis of successful high-speed stock removal is largely dependent on the grade of coolant selected for any particular job, it is surprising what little information is available on the theory of cutter lubrication. This statement does not infer that cutter lubrication is in general responsible for inefficient results, although this is often true. If more care were exercised in studying by comparison the grades of cutting oils and compounds in their application to various grades of work, greater efficiency in cutter upkeep would result, with a corresponding saving in set-up time by giving longer periods between the operations of cutter regrinding.

Cutter lubrication for rapid production needs careful study to determine proper mixtures for best results. Soda water makes a cheap dilutant for some cutting oils, but its application may vary with each job

One of the fundamental principles of rapid production is the determining of the most suitable coolant as an agent for reducing frictional heat generated at the cutting point, later transmitted to the work itself. The question of lubrication of the bearing formed between the chip and cutting edge is also a governing factor relative to successful stock removal, and is mainly responsible for producing a good finish on the work while the tool retains keenness at the cutting point. Two other important factors entering into the subject are the need of washing away chips and the protection of the finished product from rust and corrosion. These principles cover the major points of the problem, and may be directly responsible for tool success or for good work.

During the performance of any machining operation the generation of frictional heat due to the tearing of the chip results in raising the temperature of the cutting tool and of the work. The cutting edge of the tool then breaks down if heat becomes excessive. The accuracy of the work under these conditions is also affected by the possibility of metal expansion while cutting is taking place, thereby leaving the finished product too small through contraction in cooling. These points suggest very forcibly that the cooling qualities of whatever compound is used is first in importance as an aid to cutting.

Covering several phases of machining operations, such as deep hold drilling and milling, the qualities of the cutting compound as an agent for washing away chips from the cutting point are of great importance. Tools for deep hole drilling, if correctly ground, should break up the chip into comparatively small sections. Then by delivering the fluid in sufficient volume at high pressure the chips are washed out of the hole and prevent crowding or retarding at the cutting point. But unless conditions demand that high pressure be used for chip removal, such as in the case of deep hole drilling, it is more efficient to deliver the lubricant at low pressure because of better cooling and lubricating.

The major cause of the majority of tool failures is the inability of the lip surface to withstand the friction and pressure of the chip when the cutting edge is softened from the heat developed from incorrect cutting of the "rake." Much controversy has at times arisen as to whether or not cutting oils afford a lubricating action for the bearing between the lip of the tool and the chip. But the point is generally conceded that oils when used as cutting mediums are less efficient as coolants than a high grade cutting compound. The superiority of oil for certain classes of work is easily proven by the results obtained in cutting low carbon steels, or any metal producing long spiral chips. The heavy pressure at the cutting point, which may reach 10,000 lb. per square inch on heavy cuts, would make one feel certain that it is impossible to maintain an oil film at the point of contact when it is considered that a pressure of 1,000 lb. per square inch is a maximum for journal bearings where oils of approximately the same viscosity are used.

When machining such metals as cast iron, aluminum, and many grades of brass and bronze, the question of cutter lubrication is of lesser importance because the chips are broken up into smaller particles. It is, therefore, not usually necessary to improve operating conditions by the introduction of a lubricant. Cooling action rather than lubrication is of most importance on such work.

When machining large pieces a high percentage of the heat is absorbed by the work, but even when making full allowance for this fact sufficient heat will be absorbed by the tool to result in its breakdown under pressure unless a suitable coolant is applied to absorb the excess heat developed in cutting.

Finishing cuts are usually light, and consequently produce less frictional heat. As a consequence an equally good finish will usually be obtained even when a lubricant is not applied to the tool. But when conditions necessitate the use of an oil or cutting compound

only a thin film is actually required at the cutting point. By its use it is often possible to use a higher spindle speed and feed than if the work were machined dry.

When considering the adoption of any cutting compound its rust prevention qualities must also be thoroughly determined, otherwise considerable loss may be entailed through rust or the formation of verdigris. This is particularly true on brass when using lard oils containing a high percentage of free fatty acids. Vegetable oils do not have this injurious action, but they are liable to give trouble in gumming up the working parts of machines.

Going back to the early investigations of Fred W. Taylor at the Midvale Steel Works in 1883, it was found that a higher speed and feed could be used where a concentrated stream of soda water solution was directed on to the chip at the point where it was removed from a steel bar. This solution of soda water proved unsatisfactory in many cases and later experiments in adding certain grades of oil to the coolant secured better results. Lard oil proved to be one of the most satisfactory mediums for compounding in the soda solution, and is still considered by many as being the best lubricant for the greater range of cutting.

The use of lard oil as a cutting lubricant is limited by two considerations, namely, high price and a tendency to gum unless mixed with other oils of a lighter consistency. This eventually led up to the introduction of soluble oil cutting compounds, which in many cases are mixtures of lard oil with certain mineral and vegetable oils, soda, and soap emulsions. These mixtures are intended to prevent corrosion of work and afford some lubricating action while cutting.

Uniformity of the solution is of great importance in the mixing of soluble oils, as the separation of the ingredients may result in the delivery to the tool of a solution too thin and watery, resulting in washing the lubrication from bearings and even rusting both machine and work.

The use of lard oil undoubtedly furnishes the best cutting medium for work where the amount of heat generated is large. The best quality should be used in order to avoid an excess of free fatty acids, which set up a corrosive action. A safe percentage is from 15 to 20 per cent. This specification may bring the price high, but for many grades of work it can be mixed with a good grade of mineral oil with good results.

Cutting oils soluble in water have found a wider use due to their lower cost. In such industries as nut and bolt manufacture, where competition is keen and low production costs constitute a big factor, the results have proved very satisfactory.

Where a laboratory test is not available it is not a safe practice to allow the section of a cutting to compound be based wholly on low price. Different mixtures appear identical, yet their suitability for the work may vary widely. The safest course to adopt is to purchase from a source of supply backed by a good reputation, and not follow the natural tendency to favor the selection of the compound which can be purchased at the most advantageous price.

Owing to the many varied conditions entering into the problem of cutter lubrication it is difficult to outline definite regulations as a basis to govern each case, but several facts are worthy of note here. Machining conditions demanding a medium depth of cut at low or medium spindle speed need little lubricating action. On the other hand a low spindle speed and heavy cut, particularly when the material is tough, will demand a coolant possessing high lubricating properties, probably requiring the use of a cutting oil exclusively. Shallow cuts at high speeds will call for a fluid possessing superior cooling properties and a capacity to absorb heat. If a low viscosity cutting oil is used the heat developed will cause excessive heating of the tool, and will result in the need of frequent regrinding.

Heavy cuts operating at comparative high speeds call for a mixture combining both cooling and lubricating properties, the proportions being governed by the nature of the job. Provided that the material to be cut is not unduly tough, the quality of the fluid should be more of a coolant than a lubricant. Where the stock is inclined to be hard or tough, as in the case of many alloy steels, a heavily compounded solution giving effective lubricating action is necessary. Finally, the conditions are so varied that a satisfactory coolant selected for any particular case must be governed by the type and general condition of the machine, together with the speeds, feeds and the depth of cut, and ought to be the result of careful study and experiment.

Ten Rules for Foremen

BY J. MADDEN

The ten rules for foremen, enumerated here, are given a conspicuous place in the shop office of the Link-Belt Meese & Gottfried Co., San Francisco, Calif. The rules are not original with the company and their source is unknown. Regardless of where the credit for their origin should be placed, they are of indisputable value.

1. *Be fair.* Have no favorites and no scapegoats. A foreman has to act as judge many times every day; therefore, he must be just.

2. *Make few promises and keep them.* A foreman must be exact in this particular. Sometimes a foreman forgets that his job requires a high standard of truth and honor.

3. *Don't waste anger—use it.* Anger is valuable and should not be used carelessly. Keep your most forceful language for special occasions.

4. *Always hear the other side.* Never blame a worker until he has been given a chance to give his point of view.

5. *Don't hold spite—forgive.* When you have had to scold a worker, go to him later and show him his faults in a friendly way.

6. *Never show discouragement.* Never let yourself be beaten. A foreman must have perseverance and the "never-say-die" spirit.

7. *Notice good work as well as bad.* Let the workers see that you can appreciate as well as condemn.

8. *Watch for special ability.* Take a keen human interest in your workers. Put each one where he can do his best.

9. *Take your full share of blame.* This is the most difficult of all. The foreman who can share both blame and praise with his workers has discovered the secret of managing men.

10. *Prevent accidents.* Educate or eliminate the careless man. The good foreman is known by his men.

Shop Equipment News

Hartness Flat Turret Lathe, 4x34-In.

The Jones & Lamson Machine Co., Springfield, Vt., has added a larger model to its line of Hartness flat turret lathes. The model illustrated is styled 4x34 in. and is made both as a bar machine and as a chucking lathe. The dimensions indicate maximum diameter and length of stock that can be worked. The chucking lathe is equipped with a 17-in. chuck and has a swing of 21 in. on centers and 17½ in. over the ways.

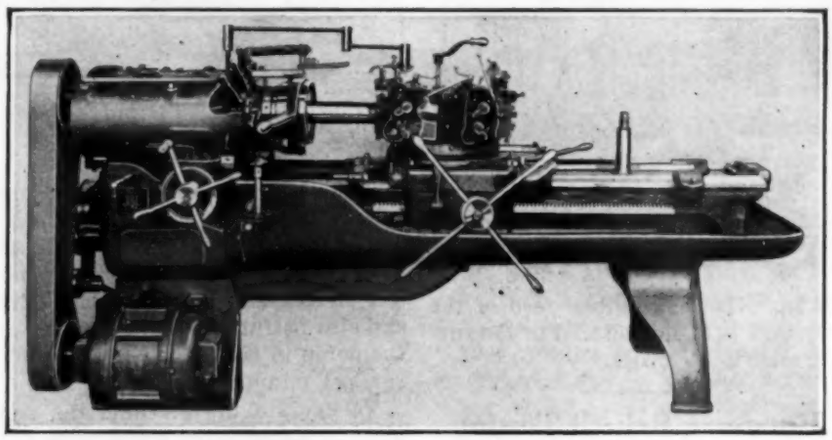


Fig. 1—Hartness Flat Turret Lathe, 4x34-In.

The headstock has been designed so as to give additional spindle capacity and also to add to the rigidity of the lathe. The spindle is 5¼ in. in diameter and has a hole 4⅛ in. in diameter. It is mounted on split bronze bearings. All the shafts and the gear heads are made of heat-treated alloy steel and are mounted on ball bearings. The gears are also made of heat-treated alloy steel. The speed changes both forward and reverse are effected by means of multiple-disk clutches. The clutches are capable of carrying any load within the capacity of the machine and will insure positive rotation equal to the heaviest cuts required with the chucking attachment.

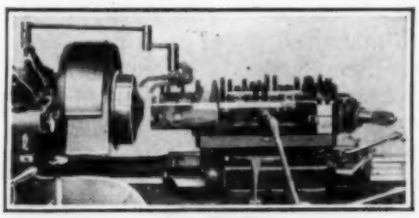


Fig. 2—Chucking attachment with square turret

The bar outfit is similar to that of the other Hartness flat turret lathes. The 17-in. chucking head, illustrated in Fig. 2, is equipped with a square turret. The large square turret and the cross-sliding headstock are said to make possible simple multiple tooling on large-diameter chuck work. Here again the tooling is similar to that on other Hartness square flat turrets. It is claimed that inexpensive standard tooling is sufficient for the majority of chucking work and that special tools are very seldom required.

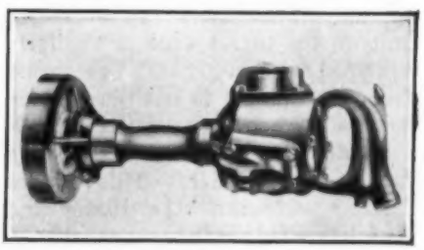
"Little Giant" Portable Pneumatic Grinder, No. 33

The No. 33 "Little Giant" portable pneumatic grinder illustrated is being marketed by the Chicago Pneumatic Tool Co., 6 East 44th Street, New York, N. Y. The grinder is for use on many classes of production work where high speed and continuous service is required.

The air motor consists of three cylinders, placed 120 degrees apart. Each cylinder is provided with its own valve of the piston type, which permits extremely short live air ports. The pistons and toggles are of the pin type, and the vent tube is of the centrifugal ball check type. When the machine is at rest the ball check is seated, thus preventing the loss of lubricant due to moist oil or a submerged vent. When in operation the ball check is unseated due to the centrifugal force and the crankcase is vented without any lubricant being lost with escaping air.

The stuffing box packing is of an improved design. It consists of cup leathers that embrace the spindle just sufficient to prevent leakage, and no adjustment is required. The valve is set to cut off at the point of highest efficiency so there will be an economy in the amount of air consumed.

The cylinders are machined from close-grained cast iron and the pistons are turned from special low-carbon steel and are heat-treated and ground. The eccentric straps and the eccentric with the vent tube element can be readily disassembled by removing the grip handle. Any one of the three cylinders, pistons, rods or valves, may be removed without disturbing the other two assemblies. By removing the grip handle and one cylinder the crankshaft may be removed.



"Little Giant" Portable Pneumatic Grinder, No. 33

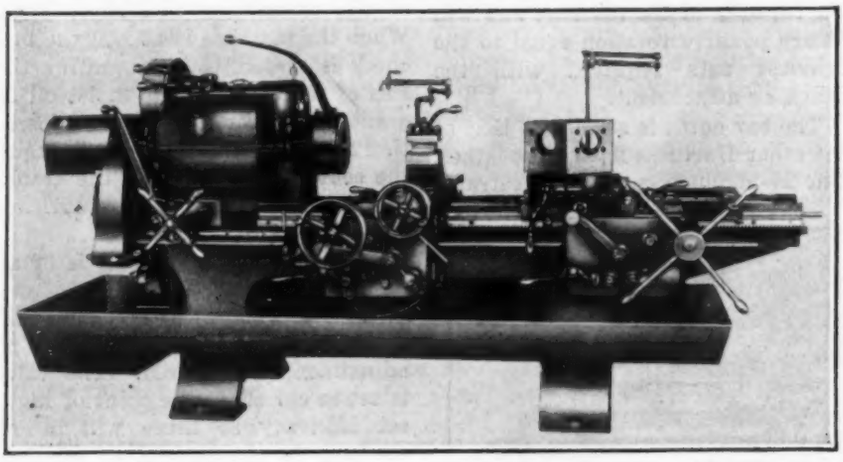
The machine is said to be well balanced, so that there is a minimum of vibration. The speed under no load is 4,000 r.p.m. The machine is designed to carry a wheel or wire brush of 6 in. in diameter by 1 in. face. The arbor is ⅝ in. in diameter. The tool weighs 15½ pounds.

Shop Equipment News

Foster Universal Turret Lathe, No. 2-B Improved

The Foster Machine Co., Elkhart, Ind., announces some improvements on its No. 2-B universal turret lathe, shown in the accompanying illustration.

Heavy-duty, multiple-disk clutches that operate in oil control the forward and reverse movement of the spindle. The power rapid-traverse unit on the turret slide is similarly equipped with clutches. The thrust from the spindle is now carried on heavy-duty ball thrust bearings.



Foster Universal Turret Lathe No. 2-B, Improved

Another feature is the split-ring type turret binder. This binder entirely surrounds the turret and clamps on a ledge of almost equal area. The design is such that the clamping action is almost directly under the tools, so that rigidity is assured.

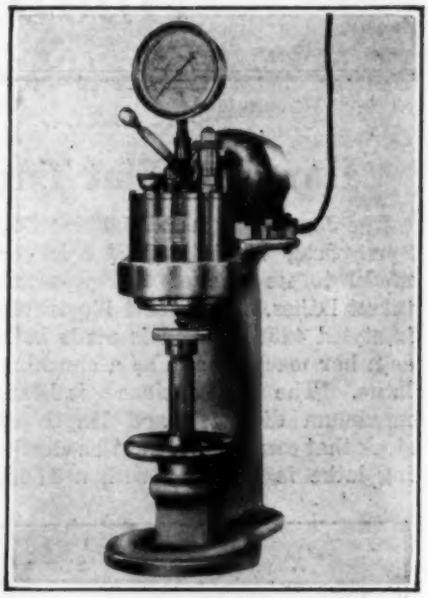
The shafts carrying the sliding gears are now splined and all sliding keys are eliminated. The shafts are made of chrome-nickel steel and are heat-treated. All gears in the head are turned from forged steel and are heat-treated. They operate in a bath of oil. The spindle itself is a forging and is heat-treated and ground to its final size. Twelve reversible spindle speeds may be obtained. These range in geometrical progression from 16 to 325 r.p.m. The gears in the power feed units are also made of steel and run in oil. The worm gears, however, are made of a special composition bronze.

The bed of the machine has been lengthened 12 in. The machine now swings work 22 in. in diameter over the bed and 13½ in. in diameter over the cross-slide. The round bar capacity through the automatic chuck is 3¼ in. The maximum distance between the face of the hexagon turret and the spindle nose is 54 in. The longitudinal feed of the carriage is 47 in. and that of the turret slide is 44 inches.

Pittsburg Brinell Testing Machine, Power-Driven

The Pittsburg Instrument & Machine Co, Pittsburgh, Pa., is marketing the power-driven Brinell testing machine illustrated. The machine has been designed for the rapid inspection of large quantities of material. Controlling weights have been eliminated and instead the load is applied by means of an hydraulic system controlled by a valve. It is claimed that the number of tests per hour is thereby greatly increased.

The pump for supplying the hydraulic pressure is a rotary type and is made of bronze and steel. The rotor is mounted on Timken roller bearings. The stroke of the piston is more than ½ in. and the plunger returns quickly to its original position after each operation. When specimens of uniform thickness are being tested, the plunger has sufficient travel to allow for the insertion and removal of the piece without adjustment of the bottom screw by means of the handwheel. Glycerine is used as the fluid medium and is controlled by means of a pressure valve on the right side of the cylinder.



Pittsburg "Brinell" Testing Machine, Power-Driven

The machine is regularly equipped with a ⅓-hp. electric motor, either a.c. or d.c., as specified. Belt drive can also be furnished. The speed of the pump in either case is about 300 rev. per minute.

To operate the machine the test piece is placed on the screw table and is brought into contact with a 10-mm. steel ball. The valve is then operated and the maximum pressure of 3,000 kg. is instantly reached. By releasing the handle the operator can remove the test piece and insert another. An attachment can be furnished for operation of the valve by means of foot pressure. With this method the operator can use both hands to remove or insert the specimen.

This testing machine is furnished in three sizes. The standard size will take test pieces up to 6½ in.; the medium size has a gap of 12½ to 13 in. between the steel ball and the screw table; while the largest size will accommodate test pieces up to 18 and 20 inches.

Forbes & Myers Electric Tool Grinder, Model 75

The model 75 electric tool grinder illustrated is being marketed by Forbes & Myers, 172 Union Street, Worcester, Mass. The grinder is designed for use on electric light

Shop Equipment News

circuits of 110 or 220 volts, single-phase. The motor is of single-phase squirrel-cage type, and brushes and commutator have been eliminated.

The grinding unit is of the flat front type. The flat is only 1⅛ in.

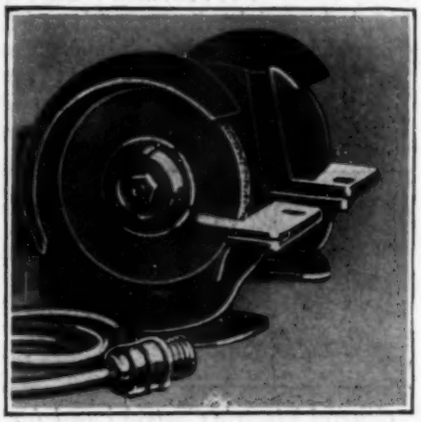


Fig. 1—Forbes & Myers Electric Tool Grinder, Model 75

from the center of the shaft, so that a 6-in. wheel projects well in front of the motor. The motor is rated at ½ hp. and is fully inclosed.

The rotor is shown in Fig. 2. It is a simple squirrel cage induction type similar to rotors used on three-phase circuits. It consists of an iron core mounted upon a steel shaft. Aluminum bars are inserted in slots in the core, and are welded together at each end into a solid aluminum ring by means of an acetylene torch. This construction is said to result in a solid, single piece.

The stator is of the usual laminated type with slots for the winding. The main coil is of heavy wire,

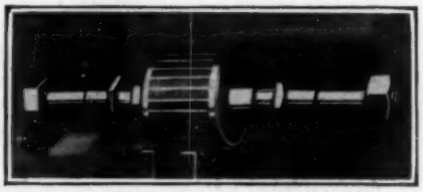


Fig. 2—The squirrel cage rotor

and receives its current directly from the line. An auxiliary winding of many turns of fine wire extends half the distance across the stator, and receives its current through a condenser mounted at the rear of the motor. Both windings are used simultaneously.

The rotor is mounted upon ball bearings packed in sufficient grease for three months' continuous use, or for longer periods, if the machine is used intermittently. Tool rests are provided that are adjustable in two directions. A switch is located at the rear of the machine. Six feet of lap cord and a plug are standard equipment.

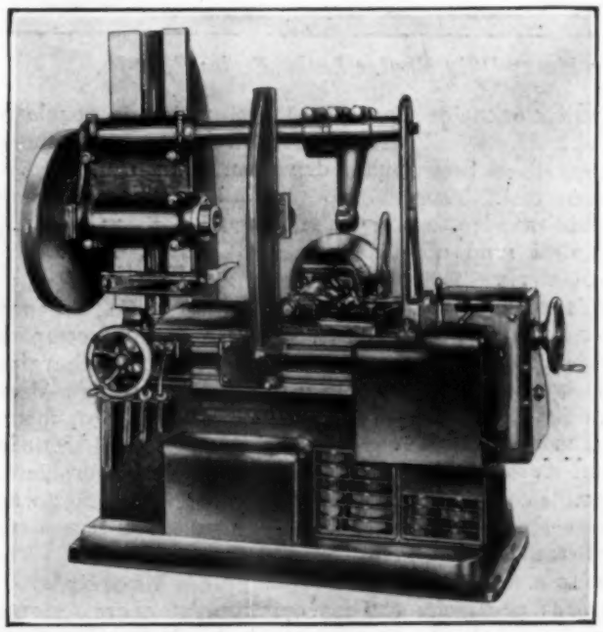
Brown & Sharpe Automatic Gear-Cutting Machine No. 4, Improved

The Brown & Sharpe Manufacturing Co., Providence, R. I., has made a number of improvements on its No. 4 automatic gear-cutting machine. The design is such that heavy work can be set up rapidly and at the same time a high degree of accuracy is maintained.

The most important improvement is in the method of supporting the gear blanks. The work spindle slide has been made heavier, and it is equipped with a solid steel overarm which clears gears up to 19¾ in. in diameter. The arm carries a work support head which is equipped with an adjustable center. The center supports the outer end of the work arbor and a device is provided for relocating the head after it has once been centered.

The overarm is further supported at its outer end by a heavy vertical brace, which is securely fastened to the bed of the machine and to the feed case. An upright support, sliding on ways on the front of the bed, takes all work up to the full capacity of the machine. The work spindle slide has a wider and heavier strap and gib. The side walls that support the upright ways of the bed have also been thickened to provide additional support.

The feed screw that operates the cutter slide has been increased in diameter to give greater durability. The index-worm shaft has also been increased in size and has been provided with a heavier index-worm bracket. The outer bearing of the cutter spindle is a tapered bronze bushing, so that adjustment can be made to compensate for wear.



Brown & Sharpe Automatic Gear-Cutting Machine No. 4, Improved

Sirianni & Trumbettas Flexible Power Unit, No. 112a

The flexible power unit No. 112a illustrated is an improvement of the No. 112 unit made by the Sirianni & Trumbettas Co., Carbondale, Pa., and described on page 694, Vol. 64, of the *American Machinist*.

While the former unit was a single-speed machine, the present model is capable of three standard speeds as determined by a three-step cone pulley; 700, 1,750 and 3,500 r.p.m. are available. By using special pulleys, speeds as high as 22,000 r.p.m. can be obtained, in which case both ends of the flexible shaft can be fitted with ball bearings. The hand piece is regularly equipped with "Superba" ball bearings.

The entire unit is mounted on a swivel base and swings in a complete circle. The motor is rated at ½ hp.

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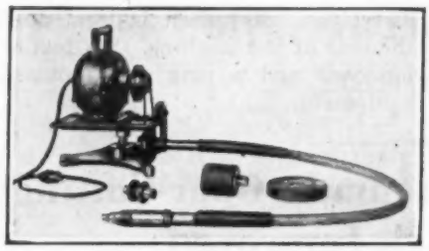


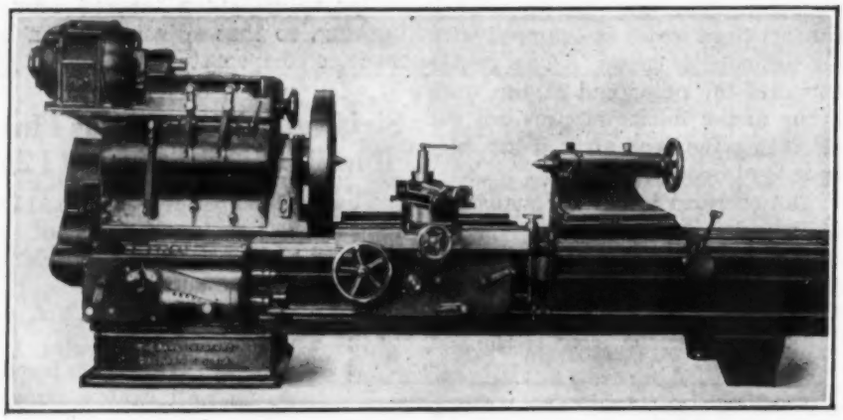
Sirianni & Trumbettas Flexible Power Unit, No. 112a

An arm is provided to keep the flexible shaft in alignment at the pulley. The core or driving member is a hard wire wound cable ¼ in. in diam. It is inclosed in a zinc plated steel spiral case that is said to be oilproof. The motor is equipped with a carrying handle to permit the unit to be easily moved from place to place.

Power units can also be mounted on a column the same height as a bench. The tool is said to be useful for snagging, light grinding, polishing, carving, rotary filing, drilling, and the like, where a portable and flexible power unit is desired.

Rahn-Larmon Heavy-Duty Engine Lathe Series F, 30- and 32-In.

The Rahn-Larmon Co., Cincinnati, Ohio, has redesigned its series F heavy-duty engine lathe in sizes 30- and 32-in. The series F lathe is equipped with single pulley or motor drive and an all-geared head.



Rahn-Larmon Heavy-Duty Engine Lathe, Series F, 32-In.

Four special features have been added to the redesigned tool. The tail stock has been made massive to take care of the heaviest kind of steel-mill and railroad work. The carriage has been widened and the compound rest has been strengthened and widened on the slide. The apron is the double wall type and is equipped with a self oiling device for the rear bearings. The apron has been arranged for friction cross feed.

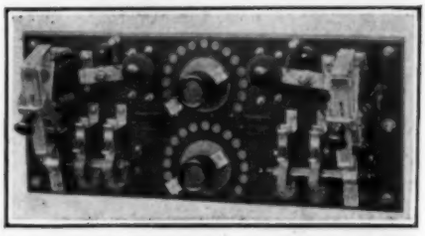
The feed of the apron is controlled by a heavy-duty, all-steel gear box. It is possible to cut threads having a lead of ½ in. down to a lead corresponding to 24 threads per inch. The gears are forged and heat-treated and are mounted on chrome-nickel steel driving shafts.

The all-geared drive head gives 12 spindle speeds ranging from 5 to 275 r.p.m. approximately. The spindle itself is a heat-treated forging. A 15-hp. motor is regularly used to drive this lathe, but a single pulley drive can also be provided.

General Electric Battery Charging Outfit

The General Electric Co., Schenectady, N. Y., is marketing a complete line of improved battery-charging equipment in uniform frame sizes. The equipment consists of motor generators and unit control sections. They are particularly applicable to the multiple charging of batteries used in electric industrial trucks and storage battery locomotives. The unit control panel is illustrated.

The motor generators are designed to operate at speeds ranging from 1,800 r.p.m. for sizes up to 35 kw., to 1,200 r.p.m. on larger sizes. The generators are flat compounded between no load and three-quarter load, and have slightly drooping characteristics beyond the three-quarter load point. The rise in voltage between these two load points is comparatively small. The standard voltage is 115, but special voltages, such as 32, 45 and 55 volts, can be obtained. The proportions of the generators are liberal, and the commutators and brushes have ample capacity for the high current required for this work. The unit control panels are compact, so that it is possible to control a large number of circuits in a limited space. The two-circuit section illustrated is for manual control of the charging rate. The charge is terminated by means of a contact-making ampere-hour meter located on the truck. The panel contains for each circuit a dial switch for the resistor, a meter reading switch, an indicating lamp, a double-pole undercurrent and shunt-trip contactors with two auxiliary circuit contacts, a fuse mounted conveniently on the back of the board, and a resistor also on the back of the board. By means of the indicating lamp, the operator can tell when the battery is connected to the section. The current is controlled and adjusted by turning the dial switch handle. Amperes and volts are read by the meter-reading switch in connection with a voltmeter and ammeter common to all circuits.



General Electric Control Panel for Battery Charging

Overcurrent protection is provided by the fuse, and protection against reversal of current is furnished by the undercurrent contactor. Automatic shutdown at the end of the charge is accomplished by the shunt trip device, which is an integral part of the undercurrent circuit breaker.

The construction of the panel is such that a single section with its two resistors may be withdrawn, if necessary, by removing four cap screws at the corners of the panel

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and detaching the vertical bus bars from the back of the resistor supports. Any number of control sections can be combined with generator sections to make a complete panel. Various modified forms of sections are available to suit different conditions of battery charging.

Smith Worm Reduction Units

Three worm gear reduction units have been added to the line manufactured by Winfield H. Smith, Springville, N. Y. The units are all for small horsepower capacities.

The No. 8 vertical reducing gear is shown in Fig. 1. Reductions of 40 to 1, 20 to 1, or 10 to 1 can be furnished similar to the standard horizontal-drive No. 8 reducing unit. The horsepower capacities for the various reductions are 2, 3 and 5 hp., respectively, at 1,800 r.p.m. of the worm shaft. The illustration shows the driven shaft extending through the top, but if desired this shaft can be extended and the drive taken off the bottom. This type of unit is designed especially for use in connection with mixing machines, agitator tanks, merry-go-rounds, and the like.

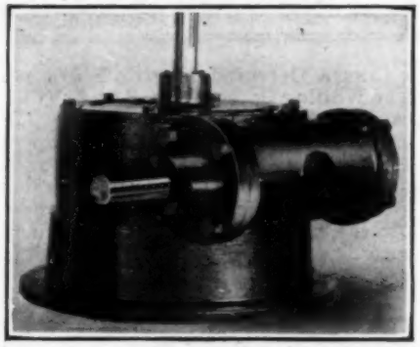


Fig. 1—Smith Worm Gear Reducing Unit, No. 8

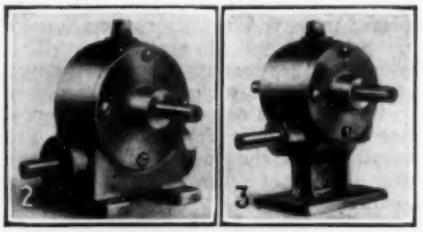


Fig. 2—Reducing Unit No. 2½
Fig. 3—Reducing Unit No. 3A

The No. 2½ reducing unit shown in Fig. 2 is for use with motors up to ½-hp. capacity. The standard reduction is 40 to 1. Bronze bearings are used on the high-speed shaft. The height from the bottom of the base to the top of the housing is 5½ in. The weight is 8 pounds.

The No. 3A reducing unit shown in Fig. 3 is for use with motors up to ¾-hp. capacity. Reductions of 20, 10, and 5 to 1 are available as standards. This unit has been redesigned, but has all the essential dimensions of the old unit known as No. 3.

Whitcomb Planer, 24-In., Improved

The Reed-Prentice Co., Worcester, Mass., announces some improvements in its 24-in. Whitcomb planer, shown in the accompanying illustration.

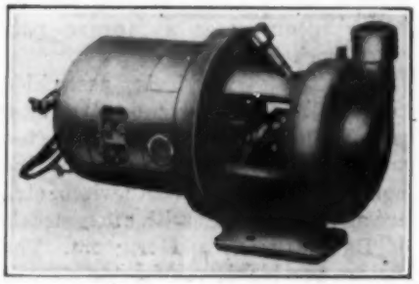
The bed of the machine as now made is a box type, as is the table, which has been liberally cored out to reduce the dead weight to be reciprocated.

All the bearings in the driving system are lubricated by means of a forced-feed system. A Madison-Kipp lubricator is bolted on the side of the bed and is driven by means of a belt from the main drive shaft. All other parts are lubricated by gravity feed. A central station is provided for maintaining an even level of oil in all the pockets.

Goulds Motor-Driven Centrifugal Coolant Pump

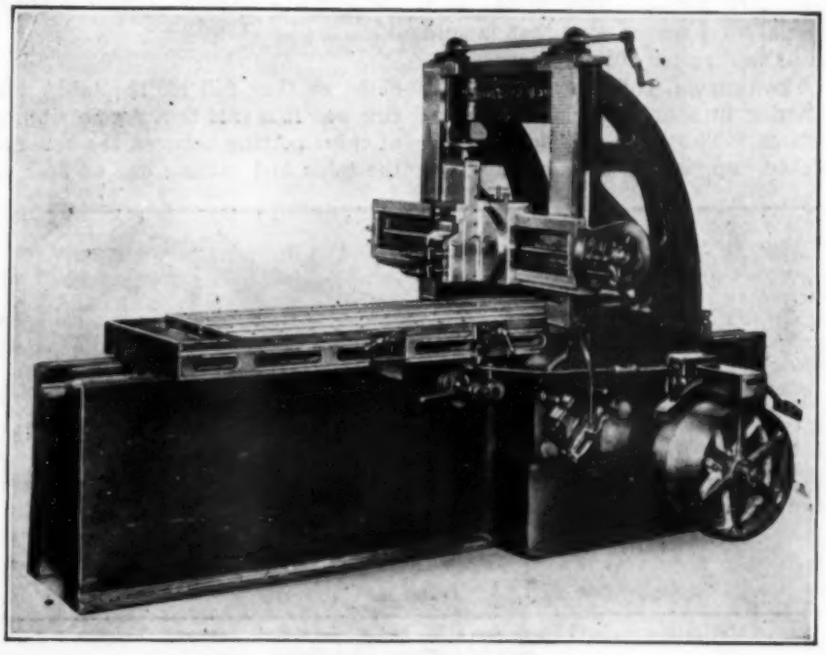
A small motor-driven centrifugal coolant pump has been placed on the market by Goulds Pumps, Inc., Seneca Falls, N. Y. The pump proper is identical with the coolant pump described on page 842, Vol. 64, of the *American Machinist*. It is designed to handle the cooling compound for machine tools.

The design of the pump is such that it will pass chips without clogging or producing undue wear. The casing is bolted to the frame with eight studs, and by shifting the casing with respect to the frame the discharge can be placed in any one of eight directions. The pump itself will operate in any position, as will the motor. A bronze washer carries the thrust load.



Goulds Motor-Driven Centrifugal Coolant Pump

The motor will also operate in any



Whitcomb Planer, 24-In., Improved

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position. Its weight is carried on a separate thrust bearing. The motor is a ¼-hp., General Electric, a.c. type. It operates at 1,750 r.p.m., and is for use with 110- or 220-volt, single-phase, 60-cycle current.

The rated capacity of the pump is 20 gal. per minute at a pressure of 9 lb. per square inch. The unit measures 16 in. overall and 9 in. in height. The pad for bolting the unit to the machine measures 4⅜ x 3¼ inches.

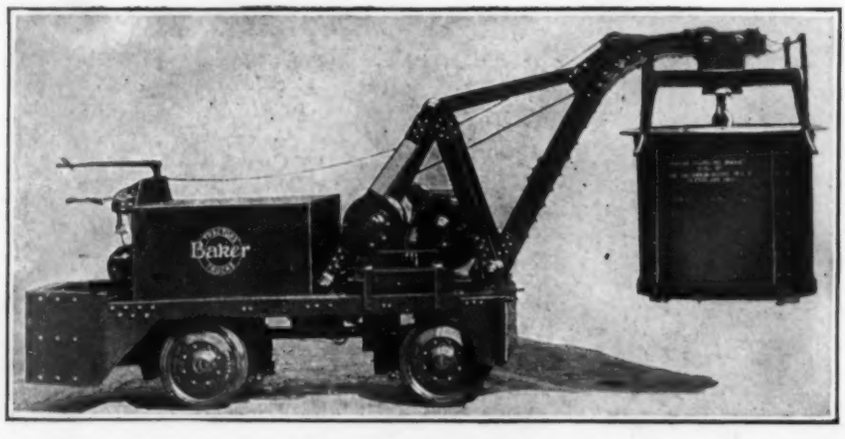
Baker Cupola Charger

A crane type of electric truck suitable for cupola charging is announced by the Baker-Raulang Co., Cleveland, Ohio. The machine operates in conjunction with the Chisholm & Moore 1-ton charging bucket, which incorporates a Morgan patented bucket yoke.

The truck itself is assembled principally from standard Baker parts. The axles, the controller, the automatic switch, the hoist, the hoist controller, the limit switch, etc., are all standardized with other models of Baker trucks and tractors. The motors receive power from a 48-volt storage battery contained in the large steel box near the driver's end of the truck.

The boom is strengthened by a steel plate on the side toward the fire. This construction is used to keep the heat away from the cable as well as the hoist and other truck operating parts. The cable is a special steel center rope that is said to be well suited for this service.

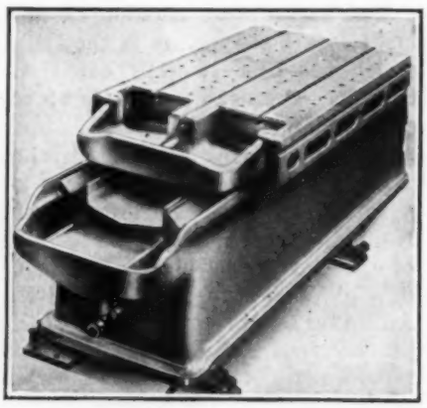
The cupola charging bucket is circular in shape and has a conical bottom. The bucket is loaded and picked up by means of an eye fastened to the center of the bottom. When the bucket is raised, four dogs on the yoke engage with the angle-iron ring around the top of the bucket. When the hoist is reversed the bottom of the bucket drops, while the shell is held up by the yoke. The upward travel of the hoist is protected by an automatic safety switch, which cuts off the power when the bucket has been raised so that the ring is 1 in. above the dogs.



Baker Cupola Charger

Cincinnati "Hypro" Planer Table, Improved

The Cincinnati Planer Co., Cincinnati, Ohio, has added a new feature to its "Hypro" planers. A pocket has been cast integral on the end of the table for the purpose of catching chips as they fall off the table. In this way it is said that the possibility of chips getting between the bed and the table and cutting one or both is obviated, and the accuracy of the planer is not impaired. In the past home-made shields have been used to prevent chips from falling on the feed, or in some cases a pan or guard was bolted to the table. In order to prevent an unsightly appearance, this pocket has been cast integral with the table. It is heavy enough to stand rough usage and is large enough to catch and carry all the chips that will come off the end of the table.



Cincinnati "Hypro" Planer Table, Improved

In case the work is extremely high and must be blocked on the end, the pocket walls can be used as stops, thus giving greater capacity to the table.

Trade Catalogs

Cranes, Overhead, Electric Traveling. The Whiting Corporation, Harvey (Chicago) Ill., has issued bulletin No. 176 entitled "Standard Building Clearances for Whiting Overhead Electric Traveling Cranes." The bulletin contains tables of the fifteen principal clearances for the various types of cranes rated according to capacity and span.

Cranes and Hoists, Electric, Lubrication of. The Shepard Electric Crane & Hoist Co., Montour Falls, N. Y., has issued a bulletin on the subject of lubrication of its cranes and hoists. The first part of the bulletin is devoted to describing the various types of oil recommended and the points of lubrication. Each piece of equipment is treated separately, and the information is summarized in tabular form on one page. The remainder of the bulletin takes up the lubrication of separate units by use of phantom views shown in true perspective. No mechanical line drawings are used. The crane trolley is first shown, then the electric traveling crane as a whole, the single I-beam crane, the hoist unit, the Model 20 trolley, the geared crane trolley, and the back geared motor. The illustrations for the crane trolley and the electric travelling crane unit are mounted on heavy paper so they may be tacked up in the shop or in the crane cab for easy reference. Recommendations for lubrication are tabulated on the corner of each page with the aid of reference letters on the phantom views.

Fans, Baby Conoidal. The Buffalo Forge Co., Buffalo, N. Y., has issued catalog No. 475 on its "Baby Conoidal" fans. The bulletin contains engineering data and ratings of this fan with a "Niagara," "Duplex," or "Turbo" wheel. Tabulated dimensions are also given. Illustrations of the fan and its applications are shown.

News of the Week

German Exports of Machinery from January to June, 1926

Previous conditions compared with the present

BY OUR BERLIN CORRESPONDENT

During the time of inflation, now happily a matter of the past, the mentality of the German manufacturer has drifted into a certain channel of thought from which he does not seem to be able to return. Export business stands uppermost in his mind and the domestic business is something which he expects to keep going of its own accord, ebbing and flowing with market fluctuations.

DOMESTIC BUSINESS IS POOR

This is the key to the apparent riddle which presents itself when hearing on the one hand the complaints of manufacturers about bad business and when scrutinizing on the other the export returns. The domestic business, no doubt, is bad and has been so far more than a year, for reasons beyond the control of the individual and the only blame that can be attached to the German manufacturer is that he does not realize, does not seem to be able to realize that the domestic business needs at least the same amount of nursing as the foreign end—that selling is at its best a hard task and that difficulties in that direction are all in the day's work.

The German manufacturer's everlasting complaints and the foreign observer's opinion (gathered from the naked export figures) that all is "Jake" with German industry no doubt both overshoot the mark. The truth is that the German machine builder is doing at least a fair, or medium amount of business which seems poor to him because he has been used to something better and is awaiting impatiently the advent of the domestic boom. In the meantime his preference for the export business is perfectly justified, because German industry has, during and after the war, quite outgrown the purchasing capacity of the domestic market and will now and in all future be dependent on exports.

PICTURE IS DECEPTIVE

This must be understood, when viewing the returns of Germany's machinery trade in the first half of the current year, which present a picture of prosperity that is highly deceptive. However, the statistics doubtless form a flattering tribute to the intelligence and perseverance of German manufacturers, exhibited in recovering the vast amount of ground lost when the Mark again became a Mark.

In the following is seen the German machinery export in January-June, 1926, in comparison with the corresponding period of 1925, 1922 (the climax of inflation times) and 1913, the last complete pre-war year.

The grand total was 213,756 tons in comparison with 175,400 tons in 1925, and has therefore increased by 38,000 tons. It did not, however, come up to that of 1913, not even that of 1922. Looking, however, at the ad valorem figures a decided progress is clearly perceptible. From a gross average of 1,150 M. per ton in 1913 the average price per ton has risen to 1,770 M. which approximately corresponds with the general movement of prices in Germany and in the whole world. The average price of 1922, computed from the medium gold parity of the year, speaks its own sad language whereby it must be considered, that German industry was then already working with a sliding exchange.

Comparison with the inflation year of 1922 is simple. One item alone explains the higher total, the quite abnormal quantity of railroad locomotives supplied to foreign countries, chiefly Russia and other eastern countries. Nearly 54,000 tons of such engines, compared with 18,000 tons in 1913 were shipped abroad, causing an increase of the export returns by 36,000 tons during this period.

The year 1922 was the great year of German locomotive production. Since then it has dwindled steadily. The same applies to power generating machinery. Stationary steam engines are not in demand any more and German steam turbines not yet in demand. The export of hydraulic power machinery, in which manufacture Germany once was predominant, has also dropped and were it not for the brisk demand for stationary combustion motors, which contributed 11,000 tons to the total of 18,000 tons the export returns would present a sad picture of depreciation. In nearly all other fields the export figures of 1922 have been surpassed in 1926. The exceptions are wood working machinery of which in 1922 Holland and Austria bought far more than in 1926, forging, shoe and leather machinery. In a number of cases the figures almost balance but in others the returns of 1926 were decidedly better than in 1922 in spite of more than double the price of the products. It will be granted that this is a serious handicap for the exporter to overcome.

TEXTILE MACHINERY PROGRESS

The most prominent progress has been made in the case of embroidery and knitting machines; textile machinery in general, chiefly weaving looms and cotton dressing machinery, but practically encompassing all lines; metal working machine tools and agricultural machinery (chiefly harvesters). By comparison with the returns of 1913 it appears that in most lines the figures of that year, which, however, are the best in Germany's pre-war prosperity, have not been reached. In a small number of cases they almost tally, as in the case of pumps, agricultural machinery, hoisting machinery, leather and shoe machinery. Only in two cases a decided advance has been made; in that of metal working machine tools and printing presses. All in all the German machinery export in 1926 must be called highly satisfactory. It is thoroughly sound, as the fair and rising average value per ton indicates and has netted to the German balance of foreign trade a tidy credit item of 347 million gold Marks, compared with 286 million Marks in the same period of 1913 and 244 million Marks in 1912.

German Machinery Exports, January-June, 1926

(Weight Stated in Metric Tons)	1926	1925	1922	1913
Steam locomotives and tractors	10,513	12,408	53,913	18,214
Power generating machinery	18,491	17,627	21,007	27,338
Sewing machines	5,607	7,689	5,844	10,514
Embrodiery and knitting machines	5,477	3,158	3,243	6,614
Textile machinery	17,296	15,044	11,427	19,276
Pumps, fire engines	5,363	5,136	4,733	5,671
Metal working machinery and tools	32,857	19,716	28,493	26,311
Wood working machinery	4,924	4,945	7,439	6,704
Forging and riveting machinery, including pneumatic tools	1,286	1,398	1,505	2,906
Agricultural machinery	36,382	27,679	27,017	38,885
Paper machinery	3,604	3,534	2,107	4,233
Refrigerating machinery	1,544	1,386	1,766	1,114
Hoisting and conveying machinery	3,264	2,697	3,441	3,170
Book binding machinery	2,962	2,932	3,086	3,299
Ore dressing machinery	2,491	1,598	1,767	3,834
Dredgers, pile drivers	2,449	1,082	1,059	3,227
Ventilators, exhaustors, etc	1,663	1,548	1,104	1,883
Leather and shoe machinery	2,008	2,260	3,266	1,911
Machinery for the ceramic industry	4,032	3,157	3,376	6,651
Printing presses	5,848	5,552	5,671	2,992
Cranes	4,709	1,685	3,361	3,127

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

(Copyrighted, Theodore H. Price Publishing Corporation, 16 Exchange Place, New York)

THE magnitude of the recent advance in the stock market is not generally realized. But an analysis of some of the stocks and a comparison with the year's low prices and the closing prices for August 16 shows gains ranging from 26 to 130 points and averaging 56 points. The rise in the money value of the shares dealt in on the New York Stock Exchange, the Curb Exchange and the counter or telephone market has been enormously increased. To figure out the enhancement precisely would be difficult but it runs well into the billions. In U. S. Steel and General Motors alone it exceeds half a billion.

As one contemplates this showing he finds himself asking whether or not it s real and wondering why people should now be eager to buy stocks that could have been bought for so much less a few months ago. The answer is sentiment. Earlier in the year the public mind was receptive to unfavorable news. Now the optimist has the floor and but few will listen to the pessimist.

But the change in underlying conditions is slight. There was little or no unemployment last spring. There is none now. The 120,000,000 who compose the population of the United States are buying practically all they want and more than they need.

All the statistics indicate a small but fairly constant increase in trade. Basic commodities are upon the average slightly lower than they were last spring. Over-production in some industries is complained of, but production and consumption are never exactly equal and the maladjustment is slight.

The farmer's distress of which so much was heard last spring cannot have been much relieved for most agricultural products are lower. The sales of agricultural implements are nevertheless increasing and the mail order business shows an almost constant gain.

Material conditions five months ago and now are, in fact, so nearly identical that we are compelled to admit that the phenomenal advance in the stock market must be due to a change in the psychological attitude of speculators and investors. If this be true then we shall have another psychological change when the specultors have bought all they can carry and the investment fund has been absorbed.

That time does not seem to be far away. The Federal Reserve Bank of New York appears to have sensed its approach by raising its rate and it is expected that the Federal Reserve Banks of Philadelphia and Boston will soon announce an advance in their discount rates which now stand at 4 per cent. It is also to be observed that cautionary advice is now being heeded in some quarters and that the old bogy of instalment buying is again attracting attention. It is hard to say how much attention it deserves but it is now asserted a great many of the recently issued securities have been sold on the instalment plan and that more than five billions is due by those who have bought automobiles, motorcycles, radios, furniture, refrigerators, washing machines, sewing machines, pianos, etc., to be paid for in the future.

Of course the payment of these obligations presupposes continued employment at good wages. Therefore it is important to note that a marked decrease in building activity is generally admitted. S. W. Straus & Co. put the July expenditures in 468 cities at 11 per cent under last year and some other authorities report a greater decrease.

Three reasons for the decline are given by the Dow Service. One is the over-valuation upon which the necessary financing has been based. Another is the inefficiency of labor and a third is the trade union tyranny that makes for the unnecessary duplication of work. It is added that "The building investment public is very soon going to learn some startling things about the operation of modern shoestring building and financing methods."

The above is quoted because the building expenditure in the United States averages fully six billions annually and provides highly paid employment for a great many men. Future developments should therefore be carefully watched for they may have a profound effect upon the psychology of the markets.

It is hardly necessary to deal with the week's markets in detail. No important changes have occurred and the influences at work have been chiefly seasonal. An "intention to plant" report which suggested an increase of 14.4 per cent in the winter wheat acreage caused a slight decline.

The metal markets are unchanged. In the steel industry a pro-forma optimism persists but consumers are commencing to protest against the artificial stabilization of copper at about 14½ cents.

The dry goods trade is as active as could be expected in August. Our foreign trade statement for July shows an excess of exports valued at $31,000,000. This favorable balance is the largest since 1922 and is encouraging. Great Britain is more cheerful in the hope of an early ending of the coal strike and the franc is higher upon an interview with Ambassador Herrick who takes a very hopeful view of the financial future in France.

Trade in and with Mexico appears to have been paralyzed by the controversy between the Church and the State. For this reason the hope of an early settlement is quickened. Meantime this country seems to be immune to developments abroad and the only thing to be feared is an autogenous change in the prevailing optimism.

What's Doing in Industry

In spite of fears that we are over the peak of the present business cycle and in spite of prophecies that we are to face a downward trend in industrial activity we seem to be plodding along. Either the prophets are wrong or through somewhat artificial stimulation we have been successful in staving off the inevitable.

The New York market, which has been quite unresponsive so far this month, seems to have taken a renewed interest in life and inquiries are being sent out not in great numbers but sufficiently so to provoke some enthusiasm in the fall prospects. The general average for New England is also declared to be good.

Canada has undergone some easing off in activity but some of the steel plants are now working overtime, so that indications for the future are good. In the South conditions are better than last year at this time. The outlook is better than in four or five seasons.

The West is still feeling the effects of a boom for agricultural machinery. Indianapolis trade is spotty but holding up. Detroit, Chicago and Cincinnati have been disappointed in the automotive market but are hopeful. Some railroad want lists have been sent out. Prospects are considered as good.

Earlier in the year the public mind was receptive to unfavorable news. Now the optimist has the floor and but few will listen to the pessimist.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Cincinnati

While there has been somewhat of a lull in the past week, Cincinnati machine tool manufacturers and selling agents feel that the business pendulum is about to resume its upward swing.

Conditions are regarded as much better than they were at this time last year. A much larger number of inquiries came in than was expected, and this fact is regarded as indicative of many pressing needs that must be filled in the near future. The common forecast is that prospects for an increased demand in the early fall are very good, and manufacturers are governing themselves accordingly.

The greater portion of the week's orders was for single tools, for replacement purposes, the buying being well scattered and well diversified. Concerns in the automotive industries bought some, their purchases being confined to single tools and replacements. It is thought that this market will soon form a much better outlet, this opinion being based on the fact that an increased number of inquiries are coming from this source. Railroads did some scattered buying and submitted several good-sized lists of requirements.

Chicago

While some dealers report a slight decline in the demand for machine tools during the last week, the machinery trade in general finds the volume of business satisfactory. The month of August, thus far, shows greatly in advance of the same period last year in the matter of sales, while reports on July sales from figures tabulated since the month ended are to the effect that not in some years has there been so large a demand for tools, both new and used. One dealer in commenting on this fact said that in an experience of sixteen years as a handler of machinery he had never done such a large July business, war time activities excepted.

Railroad demand continues fairly active. The Illinois Central has recently placed orders for a few standard tools for its Paducah, Ky., shops. The Burlington is reported to be inquiring for woodworking machinery, and the Rock Island is expected soon to issue a new list. Demand from the automotive industry is negligible. General industry is furnishing most of the business now being booked, the manufacturing plants of the middle west being exceptionally active.

Detroit

Machinery and machine tool sales in the Detroit district show little change this week over last, although inquiries seem to be more numerous than for some time past, thus indicating prospects for a better fall business.

Actual orders, however, have not kept pace with expectations, but some are inclined to believe that the extraordinary amount of business done by machine tool firms in the automotive plants during the early part of the year gave machinery men hopes for a record year, hopes which have not been fulfilled.

The expansion program of many of the General Motors plants remains about the only outstanding feature of the machine tool trade. Contrasted with this activity on the part of Chevrolet, which is expanding to care for a production of a million cars a year, of Buick, which is now about tooled up for a record output, of Cadillac, which is placing orders for new equipment, and of Oakland, which is making extensive additions to its plant to handle Pontiac production, is the inactivity of most of the other manufacturers.

Some small orders are being placed here and there among machinery firms by Dodge, Packard and Paige, but most of the other plants are apparently not in the market for the immediate present, at least.

The rapid growth of the electrical refrigeration industry in Detroit during the past few months, one might even say weeks, has opened up new territory for the machine tool builder.

New York

The New York market has shown considerable improvement recently over its condition early in the month. It is the general opinion that August encountered a decided market set-back from the July records which were very favorable. August has not been, however, an abnormally low month but it has suffered the usual summer effects.

Reports this week have been much more optimistic as a whole than previously during the month. The backbone of the market, as has been the case so far, was industrial buying of replacement machines in small lots.

One company has orders for six machines for railroad shop use. Another company has sold ten milling machines of various types, two vertical surface grinders, one 13-in. geared lathe, a bench lathe, a centering machine and three jig-boring machines.

The second-hand market is considered as being just what was expected—some improvement over a corresponding period a year ago but not as good as the past July. Prospects for the fall were considered as being very good.

Inquiries are beginning to come in more rapidly than previously and quicker action is expected on them than has been the case during the summer.

New England

Buying fell off slightly during the past week in the New England territory, according to observations of sales managers and factory heads of the machine industry in New England. Although the sales were not as large as in some previous weeks this year the falling off, as a whole, will average less than 10 per cent. The inquiry business was of more substantial character and it is expected that a good percentage of it will be closed at no far distant date. Small tools are the subject of a large sprinkling of the inquiries. Hand tools are selling well. Contract business is excellent and, generally speaking, manufacturers engaged in special machinery production in Connecticut, have all the business they can handle for six to eight months. Trade in chucks and dies is improving with a better demand from foreign markets. Salesmen working out of Hartford and visiting Connecticut and New England customers report business is good in the territory. Salesmen report their volume of business so far this year has passed the total volume for the twelve months of 1925.

Canada

The metal-working industry as a whole in Canada is well employed, but during the last two weeks there has been an easing off in the demand for machine tools. A feature of the situation in the Dominion is the remarkable expansion of business taking place in the West. Recent reports from Winnipeg and other Western points are to the effect that most metal-working plants are working about 15 per cent in advance of last year's schedule, with the outlook good. Winnipeg building permits have already passed the $12,000,000 mark, the highest point reached since 1913.

Summer business in the steel industry is standing up remarkably well, and July sales are reported to have compared favorably with those of most months of the year. Mills are operating at about 70 per cent of capacity, with most departments busy. Six blast furnaces are in operation. The Dominion Iron and Steel Co. has just received an order for 25,000 tons of rails from the Canadian Pacific Railway and production work will commence immediately at Sydney, N. S. The Dominion Alloy Steel Co. is at present working at capacity, day and night; the company is reported to be about 1,000 tons behind in orders, with new and repeat orders coming in all the time.

Agricultural implement manufacturers have had a busy summer, and it is expected this year's business will show a very favorable advance over last year.

Southern District

The usual summer dullness is not so apparent as it ordinarily is in the Southeast this year, for dealers continue to give favorable reports concerning the present condition of business, stating sales as a whole are much better than they were at this time last year, and that the fall outlook is the best it has been in four or five seasons.

Garages and service stations continue to be among the most active buyers, and have been placing good orders for used, rebuilt and new shop equipment, much of this business being heavy tools such as lathes, drill presses, cylinder grinders, and the like. Smaller machine shops, however, are not buying much.

The textile industry is buying more actively from week to week, and the usual summer lull has now almost entirely disappeared. Inquiries are also unusually heavy, giving promise of a continued active call for mill machinery during the remainder of the year due to the unusually large number of new mills being erected in this section. At the present rate 1926 should prove one of the best textile machinery years of the past four or five seasons, most dealers state.

The lumber industry is buying fairly well, particularly furniture plants. Brick machinery, road building and contractors' equipment and railroad shop equipment comprise other lines that are fairly active at this time.

Indianapolis

Little change is seen in the machine tool and machinery demand here. The situation is characterized by leaders in the trade as spotty. In some industrials the demand is good and others virtually are out of the market. The general volume, however, has held up very well considering the season and general conditions. Requirements for the local automobile trade are being held to a minimum. Some inquires are being received which leads to the belief that buying for fall production increases will start shortly. A good fall business from this source is predicted.

Some demand has begun to be received from the farm implement factories both here and in Evansville, which has several such factories. These plants are beginning to speed up production in preparation for mid-winter shipments to dealers. The season promises to be an active one.

One of the biggest demands is for contractors' machinery. While the local situation is not so good, dealers here report an exceptionally brisk demand from the northern part of Indiana. It is reported that about South Bend, Fort Wayne and other such cities, contractors have more work than they can do and are buying heavily. Concrete mixers, road rollers, cranes and other such equipment has had a heavy sale. Demand for garage equipment also has held up exceptionally well and will continue so until cold weather cuts down the number of automobiles in use.

Guggenheim Fund Makes Grants to Study Aeronautics

Grants aggregating approximately $600,000 to two California educational institutions have been authorized by the Trustees of the Daniel Guggenheim Fund for the Promotion of Aeronautics, Inc.

To Leland Stanford University at Palo Alto, a fund amounting to the income on $300,000 has been awarded for the financing of experiments and study in aviation and aeronautics. Simultaneously, there has been awarded to the California Institute of Technology at Pasadena, $200,000 for the immediate erection of a permanent building to be devoted to the study of aeronautics. In addition, grants totaling about $100,000 will be made over a period of ten years for the conduct of study and experiments in this field.

Simplified Practice Makes Progress Here and Abroad

Four industries, after studying the variety of their products and the demand for the various items, adopted simplified practice recommendations representing an average elimination of 41 of their variety; 14 other industries were receiving co-operation of the Division of Simplified Practice in steps expected to result in simplified practice programs; and of 6 industries which were operating under simplified practice recommendations, 5 reaffirmed their previously-adopted programs while a sixth made further reductions of variety. These were some of the outstanding events of the second quarter of 1926 as shown by a report made by R. M. Hudson, chief of the Division of Simplified Practice, to Secretary of Commerce Hoover.

Consideration of how to weed out superfluous varieties of sizes and types is under way by groups dealing with foundry practice, foundry refractories, vitreous chinaware, plumbing fixtures, knitted underwear containers, horseshoes, typewriter ribbons and carbon papers; millwork, wooden desks, radiators, plumbing trap screw ferrules, wirebound boxes and rotary-cut box lumber.

In eight fields, Mr. Hudson reported, surveys are under way by the industries to determine whether the recommendations which they adopted some months ago should be expanded or revised.

Because the success of this group elimination of superfluous items depends on the co-operation of every person in the industry, it was declared that it is significant that 686 trade associations of manufacturers, distributers and consumers have accepted the 57 recommendations adopted by industries up to the close of the quarter; also that 9 other associations had accepted recommendations "in principle" even though not directly connected with the industries affected. More than 2,775 individual firms had accepted the recommendations. This interest was further indicated by the fact that some 200,000 copies of simplified practice recommendations have been purchased by trade extension bureaus, buyers, consumers and the like.

Foreign interest in simplified practice as a method of waste elimination and as one remedy for some of the economic problems faced in other lands, the report shows, has increased steadily. Italy has an organization, recently formed, to study and make public the work of simplified practice. The British rubber and tire manufacturers, through their Research Association have evinced a lively interest in the progress in the United States. Many requests have come from other interests in England, Australia, South Africa, Holland and Austria. Leading engineering and scientific publications in the latter two countries as well as in France and Italy have devoted considerable attention to the significance of the movement.

Post Office Department to Place Air Mail Operation in Private Hands

The Post Office Department has declared its intention of turning over the operation of the air mail lines to private enterprise. In commenting on the policy of the Post Office Department, Postmaster General New said, "There are now several concerns that are at least approaching a condition to take it over and are manifesting a willingness to do so. This is exactly what the Post Office Department has had in mind in developing and carrying forward the air mail. It has been demonstrated to all who might be interested that communication by air between distant points was possible both by day and by night with dependable regularity and marvelously fast time.

"Contractors are learning that to be successful they must carry passengers and express and it is not going to be long until someone puts in a full service of that character. It is not true that all the contract air mail lines are losing money but it is true that most of them are, and most of them must so long as they depend upon mail only."

Tests Conducted on Oxwelded Roof Trusses

An analysis of tests conducted during April and May of this year is being made by the Linde Air Products Co., New York, N. Y. The tests were preceded by studies of the problem of oxy-acetylene welded steel roof trusses over a period of several years. These tests have been conducted at Buffalo, N. Y., by the Process Development Department of the company.

Previous to the studies on welded trusses, a series of tests on typical joints was conducted in the Carbide and Carbon Research Laboratories, Long Island City, N. Y. It is claimed that the unit tensile strength developed in these tests averaged 56,000 to 57,000 lb. per sq.in., or approximately the average maximum strength of rolled shapes.

From a cursory survey of cost data, not completely compiled yet, the tests show, it is claimed, that the cost of a welded truss will compare favorably with the cost of a riveted one of equal strength. A rigidity in favor of welding of approximately 15 per cent is claimed. This is attributed to better "fixation" on the part of column members in the case of welding.

Representatives of the Bureau of Standards, the American Bridge Co., Union College, the U. S. Navy, the engineering department of the U. S. Army, the National Tube Co., and the *Engineering News-Record*, were present during the tests.

Ford Will Build Metal Navy Dirigible

A contract for an experimental metal-clad dirigible has been awarded by the Navy Department to the Aircraft Development Corporation of Detroit, for $300,000. This corporation was the only bidder for the ship and the contract calls for delivery within 400 days to the Naval Air Station at Lakehurst, N. J. The dirigible will be constructed at the Ford air port in Michigan.

The airship will be 150 ft. long and will have a maximum diameter of 53 ft. It will have a gas capacity of 200,000 cu.ft. of hydrogen. The ship will carry a crew of four and will have provision for eight passengers as well as 600 lb. of useful load.

International Nickel Co. Buys Patent

The International Co. has purchased the refinery built by the British-American Nickel Co., at Deschenes, Que., in order to obtain a Swedish refining patent owned by the company. The British-American Nickel Co. has been liquidated and the plant dismantled. The machinery and equipment of the plant has been removed to the Port Colborne refinery and the buildings have been placed on the market for sale.

A.R.T.F.A. to Meet September 1, 2 and 3

The fourteenth annual convention of the American Railway Tool Foremen's Association is to be held at the Hotel Sherman, Chicago, Ill., from September 1 to 3.

Included in the reports to be presented is the recommendation of the standing committee on the standardization of the present special boiler taps. This committee has worked with the standards committee of the American Tap and Die Association and the proposed standardization is in line with the recommendation made by the committee appointed by the American Railway Association as reported at this year's convention with the exception that they have taken up the work where the latter association left off.

The opening meeting will be addressed by L. A. Richardson, general superintendent of motive power, C.R.I. & P. Railway and E. A. Hildebrandt, C.C.C. & St. L. Railroad, president of

the association. The report of the secretary and treasurer, G. G. Macina, C. M. & St. P. Railway will be given also at this meeting. The remainder of the time will be devoted to the appointment of committees and to the business of the association.

At a second session of this meeting, to be held in the afternoon, H. Otto, chairman of the standing committee on new labor saving tools and devices for the air brake department, will report to the association, and a report of the standing committee on the training of men suitable for toolroom work will be given by J. J. Sheehan, its chairman.

The second meeting, on Thursday, September 2nd, will be devoted to reports of the standing committee on the standardization of present special boiler taps, of which O. D. Kinsey is the chairman, and the standing committee on new tools and safety devices for the car department of which G. Reichart is the chairman. The election of officers will also be held at this meeting. The principle address will be by Edwin W. Ely, assistant director of the Department of Commerce on "Simplification, A New Tool for the Tool Foreman." There will also be a special visit to the exhibits.

A report of the standing committee on general locomotive shop kinks and devices will be given at the final meeting, on Friday, September 3rd, by J. E. Carroll, chairman of the committee. There will also be a report of the standardization committee, of which E. J. McKernan is the chairman, and of the committee of auditing, as well as of special committees.

New York University to Conduct Safety Course

With the co-operation of the American Museum of Safety, New York University will offer next month a course in accident prevention. The course will be given under the direction of C. W. Price, vice-president of the Elliott Service Co. Other instructors in the course will be Dr. E. George Payne, professor of education sociology at New York University; W. Graham Cole, director of safety, Metropolitan Life Insurance Co.; and Louis Resnick, of the New York Edison Co.

The object of the course is to equip men and women for leadership in the field of educating employees and workmen in the prevention of accidents. Industrial and public safety will be included in the course.

Business Items

The Mechanics Tool and Supply Co., Indianapolis, Ind., has established headquarters at 155 Kentucky Ave.

The Boston Gear Works Sales Co., Norfolk Downs, Mass., has adopted a registered slogan. The slogan is "Standardization Pays."

The Bridgeport Brass Co., has moved its New York Office from the Pershing Square Building to the Farmers' Loan and Trust Co., 475 Fifth Ave., at 41st St.

Homer Strong & Co., 912 Ellicott Sq., Buffalo, N. Y., have been appointed as representatives of the Monarch Machine Tool Co., in the Buffalo and Rochester territories.

The Welker-Hoops Manufacturing Co., Middletown, Conn., has been incorporated to manufacture automobile parts. The company is operating in the former I. E. Palmer plant.

The Connersville Steel Products Co., Connersville, Ind., has been formed to deal in steel and foundry products. The incorporators are, Louis F. Schleuter, J. E. Cook and Robert Doepke.

The Abram Cement Tool Co., Detroit, Mich., manufacturing cement tools and cement block machines, etc., has removed from 3818 Grand River Ave., to 2300 Michigan Ave., at 50th St.

The Northern Machinery Co., Minneapolis, Minn., is representing the Cleveland Planer Co., in the state of Minnesota and Western Wisconsin. The company will handle the Cleveland open side planers.

Holcroft & Co., Detroit, Mich., have opened two new branch offices at Cleveland, Ohio, and Chicago, Ill. H. M. Smith is district sales manager of the former and C. H. Martin is in charge of the latter office.

The Hooven, Owens, Rentschler Co., recently poured a 140-ton casting for the base of a gas engine. The metal was poured from four sides simultaneously and several weeks were needed to prepare for the pouring.

The Aircraft Corporation of America, Milford, Conn., has purchased a 70 acre factory site and plans the immediate construction of a plant at Milford, Conn., to cost about $100,000. A landing field will be laid out near the plant.

The Black & Decker Manufacturing Co., Towson, Md., has completed its Pacific Coast Home at Oakland, Calif. It will be occupied about September 1. This building will be used as a branch office, service station and distributing warehouse. The building will have a showroom for the demonstration of products of the company.

The Detroit Twist Drill Co., Detroit, Mich., is to consolidate with the Whitman & Barnes Manufacturing Co., Akron, Ohio. The Detroit firm approved the consolidation prior to August 16 when the stockholders of the Whitman & Barnes Manufacturing Co. approved the plan. Both plants will remain in operation at the present time.

The Carle Machinery Co. has been formed to acquire the plant of the Imperial Drop Forge Co., Indianapolis, Ind. The plant will be used to build and rebuild metal working machinery and is to be placed in operation before the end of August. The incorporators of the company are, Amos E. Carle, George R. Shuman, W. J. Holliday, Burrell Wright and DeLoss W. Garner.

Members of the Indiana Public Service Commission have agreed to recommend to the Interstate Commerce Commission that the Midland Railroad, from Brazil to Muncie, Ind., be not abandoned. It is understood that the Public Service Commission members feel that conditions do not warrant the abandonment of the line and that to discontinue it would work a hardship on a great number of shippers in towns through which the railroad passes.

The Durant Motor Car Co. of Canada is taking over a portion of the export business of the parent firm and recently made the first shipment the Canadian company has undertaken. The total sales of the company to date this year are 27 per cent higher than for the same period last year. The officials believe that the Canadian company can earn money on a 10,000 car production basis. It is expected that the company will manufacture at least 10,000 cars this year.

Personals

T. A. Russell, president of the Russell Motor Car Co., Ltd., sailed recently from Montreal on a business trip to England.

W. S. Jones has been elected vice-president of the Carpenter Steel Co., in charge of tool steel sales.

E. W. Buschman has been appointed as sales manager of the Foster Machine Co., Elkhart, Ind. He was formerly manager of the E. A. Kinsey Co.

Ellis F. Muther has been appointed as assistant to the president of the Gardiner Metal Co., Chicago, Ill. He was formerly connected with the Gisholt Machine Co.

Dr. E. H. Sanborn has been appointed as director of a first aid hospital to be opened by the New Departure Manufacturing Co., at its plant in Bristol, Conn. A staff of nurses will also be maintained.

J. H. Fortier, Quebec industrialist, financier and director of a number of corporations, has been elected president of the Legare Automobile and Supply Co., Ltd., Montreal, to fill the position made vacant by the recent death of P. T. Legare.

H. F. Darby, Jr., 1700 Walnut St., Philadelphia, Pa., has been appointed as direct factory representative, in Philadelphia, of the Kuhlman Electric Co., Bay City, Mich. Mr. Darby was formerly sales manager of the Cutter Electrical and Manufacturing Co.

Forthcoming Meetings

Industrial Conference. Ninth annual industrial conference on human relations, under auspices of Young Men's Christian Associations, Silver Bay, Lake George, Aug. 26 to 29.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 1, 2 and 3. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foremen's Supply Association. Annual exhibit in connection with the annual convention of the American Railway Tool Foremen's Association, Chicago, Sept. 1, 2 and 3.

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 7 to 10. William Hall, secretary, 1061 West Wabash Ave., Winona, Minn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

American Gear Manufacturers Association. Semi-annual meeting, Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 14, 15 and 16. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

DECIDED firmness is noted in the price of pig iron, although small-lot buying persists without actual upward movement in quotations. A rise of 50c. per ton in furnace coke is reported at Connellsville. Steel shows no visible signs of price advance, the range remaining about the same as a week ago on the principal hot-rolled materials. Weakness prevails in sheets and strips, both hot- and cold-rolled. Shapes, plates, and bars hold at the minimum quotation of $1.90 per 100 lb., Pittsburgh mill, on large tonnages, with a maximum of $2.10 applying on small lots of shapes and bars and $2 on plates. In the principal nonferrous materials the ratio of advances to declines is about three to one, comparing this week with last.

(All prices as of Aug. 20)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.67
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.75
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	19.76
Basic	19.76
Bessemer	19.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.25@2.30	3.89	3.15	3.50
No. 12	2.30@2.35	3.94	3.20	3.55
No. 14	2.35@2.40	3.99	3.25	3.60
No. 16	2.45@2.50	4.09	3.35	3.70
Black				
Nos. 18 to 20	2.90@2.95	4.30	3.65	3.90
Nos. 22 to 24	2.95@3.00	4.35	3.70	3.95
Nos. 26 and 27	3.00@3.05	4.40	3.75	4.00
No. 28	3.10@3.15	4.50	3.85	4.10
Galvanized				
No. 10	3.20@3.30	4.65	4.00	4.25
Nos. 12 to 14	3.30@3.40	4.75	4.10	4.35
No. 16	3.45@3.55	4.90	4.25	4.50
Nos. 18 to 20	3.60@3.70	5.05	4.40	4.65
Nos. 22 to 24	3.75@3.85	5.20	4.55	4.80
Nos. 26 and 27	3.90@4.00	5.35	4.70	4.95
No. 28	4.20@4.30	5.65	5.00	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — B.W.G. and Decimal Fractions		Outside Diameter in Inches — ⅛	¼	⅜	½	1	1½	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60@65%	55%	50%

Electric welding wire, New York, $\frac{1}{32}$, 8.35c.; ⅛, 7.85c.; $\frac{3}{32}$ to ⅜, 7.35c. per lb. *Flat, $\frac{1}{16}$@½-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.75
Tin, 5-ton lots, New York			67.25
Lead (up to carlots) E. St. Louis	8.75	New York	9.50
Zinc (up to carlots) E. St. Louis	7.40	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.50	20.50	17.00
Copper sheets, base	23.00	23.00	23.00
Copper wire, base	19.75	20.00	16.50
Copper bars, base	22.62½	22.62½	22.50
Copper tubing, base	25.00	25.00	25.00
Brass sheets, base	19.37½	19.37½	19.37½
Brass tubing, base	24.25	24.25	23.75
Brass rods, base	17.12½	17.12½	17.12½
Brass wire, base	19.87½	19.62½	19.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	28.00	27.00	27.02
Zinc sheets (casks)	13.25	12.55	12.01
Solder (½ and ½), (case lots)	40.62½	40.00	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			81.00
Commercial genuine, intermediate grade			56.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			14.75
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00 Shot			36.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.50 @12.75	11.50	11.50@12.00
Copper, heavy, and wire	11.75 @12.25	11.75	11.00@11.50
Copper, light, and bottoms	10.00 @10.50	10.00	10.00@10.50
Heavy lead	7.62½@ 7.87½	7.00	7.25@ 7.75
Tea lead	5.50 @ 6.00	5.00	6.00@ 6.50
Brass, heavy, yellow	7.00 @ 7.50	7.50	7.50@ 8.00
Brass, heavy, red	9.50 @10.00	9.75	9.00@ 9.50
Brass, light	6.00 @ 6.25	6.00	7.00@ 7.50
No. 1 yellow rod turnings	8.25 @ 8.75	8.00	7.75@ 8.25
Zinc	4.50 @ 4.75	4.50	4.50@ 5.00

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	3.60†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.95½	1.05	.94
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. kegs. †Per 150 lb. lot. ‡Per 425 lb. barrels.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb.	.1712½	.1687½	.1687½
Solder (½ and ½)	per lb.	.4062½	.40	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.55
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.56	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	29.48	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.45	1.49
Cloth	3.55	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		3.50@ 3.65
Coke, prompt foundry, Connellsville	per net ton		4.25@ 5.00
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16.75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ¼x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger. Case hardened ¼x½-in., 6c. each, less 50%.

Rivets, button heads, ½-in., ⅝-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ½-in. dia., 35c.; ⅝-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ala., Birmingham — Vulcan Rivet Corp., Boyles St., W. C. Martin, Pres.—equipment for manufacture of steel products.

N. J., Jersey City—A. Crowell, Bergen Station welding and cutting outfit.

Pa., Pittsburgh—National Tube Co., Frick Bldg.—one 8 ft. boring mill.

Ill., Cicero — Danly Machine Specialties Inc., 4914 Lincoln Ave.—tools and equipment for newly acquired plant, 52nd Ave. and West 21st St.

Mass., Boston—P. H. Frank, 803 Shawmut Ave.—miscellaneous tools and equipment, for large repair and service garage on Shawmut Ave. Estimated cost $70,000.

Mich., Detroit — Department of Street Railways, St. Jean and Shoemaker Aves.—W. H. Brieden, Purch. Agt., will receive bids until August 31 for 1 car wheel lathe and 1 turret lathe.

Ont., Ingersoll—Copelands Garage—complete equipment for repair garage to replace fire loss.

Que., Montreal—Papiveau Garage, Ltd., 191 St. Paul St., E. F. Rolland, Purch. Agt.—machinery and equipment for $20,000 garage.

Opportunities for Future Business

Ala., Birmingham—Vulcan Rivet Corp., Boyles St., awarded contract for the construction of additional buildings, for steel products plant here, to Virginia Bridge & Iron Co., Roanoke, Va.

Ark., Hot Springs—Missouri Pacific R.R. Co., Railway Exchange Bldg., St. Louis, Mo., will soon receive bids for the construction of an engine terminal, including car repair shop, etc. Estimated cost $165,000. E. A. Hadley, Railway Exchange Bldg., St. Louis, Mo., Ch. Engr.

Calif., Auburn—Placer Union High School District, soon awards contract for the construction of three 2 story buildings, including shops, here. Estimated cost $198,000.

Calif., Long Beach—Ford Motor Co., Highland Park, Detroit, Mich., is having preliminary plans prepared for the construction of auto building plant, here. A. Kahn, 100 Marquette Bldg., Detroit, Mich., Archt. Noted Aug. 5.

Calif., Los Angeles—Santee Garage, 838 South Santee St., awarded contract for the construction of 6 story, 100 x 160 ft. garage, on Santee St. between 8th and 9th Aves. Estimated cost $310,000.

Calif., San Francisco — W. H. Sullivan, Alexander Bldg., awarded contract for the construction of 3 story factory, at 10th and Bryant Sts. Estimated cost $250,000. Pacific States Electric Co., 575 Mission St., Lessee.

Conn., New Haven — New York, New Haven & Hartford R.R. Co., is having plans prepared for the construction of additions to railroad shops, here. Estimated cost $150,000. E. Gagel, New Haven, Ch. Engr.

Conn., New London—Crown Sheet Metal Wks., 186 Bank St., awarded contract for the construction of 2 story, 50 x 100 ft. workshop, on Bank St. Estimated cost $50,000. Noted Apr. 29.

O., Cleveland—W. S. Tyler Co., East 36th St. and Superior Ave., C. Zimmerman, Secy. and Treas., awarded contract for the construction of 2 story, 98 x 106 ft. foundry addition, on East 36th St. Estimated cost $75,000. Noted Aug. 5.

O., Cleveland—Willard Storage Battery Co., 246 East 131st St., R. C. Nordberg, vice.-pres. and Genl. Mgr., awarded contract for the construction of 4 story, 135 x 200 ft. factory, on Taft Ave. Estimated cost $250,000. Noted Aug. 5.

Ill., Chicago — Crane Co., 832 South Michigan Ave., awarded contract for the construction of 1, 2 and 3 story, 38 x 240 ft. factory, at 4558 South Kedzie Ave.

Ill., Chicago—J. Kulp & Co., 33 South LaSalle St., awarded contract for the construction of a 4 story, 160 x 400 ft. service garage, on West Congress St. between Morgan and Aberdeen Sts. Estimated cost $600,000. Noted Apr. 22.

Ill., Cicero—Danly Machine Specialties, Inc., 4914 Lincoln Ave., has acquired the plant of Sears, Roebuck & Co., at 52nd Ave. and West 21st St., and plans expansion, including new foundry, etc.

Ind., Aurora — Stedman Foundry Co. awarded contract for the construction of foundry, here. Estimated cost $40,000.

Ind., Indianapolis—R. T. Byers, American Central Life Bldg., awarded contract for the construction of 155 x 170 ft. machine shop and garage, at 1525 North Meridan Ave. Estimated cost $43,000.

Ind., Indianapolis—Link-Belt Co., Belmont St. and Big Four R.R., awarded contract for the construction of 2 story, 80 x 100 ft. factory. Estimated cost $50,000.

Ind., Indianapolis—Marion Motors Car Co., 1101 West Morris St., awarded contract for the construction of 1 story, 40 x 400 ft. factory. Estimated cost $42,000.

Ind., Indianapolis—Murdock Pump Co., 3500 East Washington St., awarded contract for the construction of a 100 x 200 ft. factory. Estimated cost $50,000.

Ind., South Bend — Studebaker Corp., Main and Bronson Sts., awarded contract for the construction of 2 story, 95 x 165 ft. factory, here. Estimated cost $60,000. Noted June 10.

Mass., Rutland—Central New England Sanatorium is receiving bids for the construction of 2 story workshop, here. Estimated cost $60,000. Derby & Robinson, 3 Joy St., Boston, Archts.

Mass., Winchester—A. T. Stewart, 286 Centre St., Newton, awarded contract for the construction of 1 story, 50 x 100 x 100 ft. repair garage, etc., at 662 Main St. Estimated cost $75,000. Noted June 24.

Mass., Woburn—Massachusetts Gear & Tool Co., 30 Nashau St., awarded contract for the construction of 1 and 2 story, 70 x 80 ft. factory addition on Nashau St. Estimated cost $40,000. Noted Aug. 5.

Mich., Detroit — Electric Refrigeration Corp., 2448 Buhl Bldg., awarded contract for the construction of 3 story, 300 x 700 ft. refrigeration factory, at Pennsylvania and Pere Marquette R.R. tracks. Estimated cost $2,000,000. Noted Aug. 12.

N. Y., Albany—A. Graham and F. Pinchbeck, awarded contract for the construction of a 1 story garage and service station, at 476 Central Ave. Estimated cost $45,000.

O., Ashland—Dept. Pub. Works & Highways, G. P. Schlesinger, Dir., Ohio Hartman Bldg., Columbus, will soon award contract for the construction of a 1 story, 80 x 120 ft. repair garage, here. Estimated cost $50,000. H. D. Briggs, Ohio-Hartman Bldg., Archt. Noted June 24.

O., Cleveland—Franklite Co., 5016 Woodland Ave., D. Frankel, Pres., awarded contract for the construction of 4 story factory, at 2618 East 51st St., to replace fire loss. Estimated cost $40,000.

O., Cleveland—Sawyer Gear & Mfg. Co., 5122 St. Clair Ave., W. R. Sawyer, Pres., awarded contract for the construction of 2 story, 60 x 80 ft. factory addition, at 5122 St. Clair Ave. Estimated cost $40,000. Noted May 6.

O., Sidney—Dept. Pub. Works & Highways, G. F. Schlesinger, Dir., Ohio Hartman Bldg., Columbus, awarded contract for the construction of 1 story, 80 x 120 ft. repair garage, here. Estimated cost $50,000. H. D. Briggs, Ohio-Hartman Bldg., Columbus, Archt.

Pa., Beaver Falls—Standard Steel Specialty Co. is having plans prepared for the construction of 1 story, 20 x 90 ft. manufacturing addition to plant, here. Estimated cost $40,000. Private plans.

Pa., Canonsburg—Continental Can Co. is having plans prepared for the construction of 2 story, 80 x 100 ft. factory, here. Estimated cost $80,000. Francisco & Jacobus, 511 5th Ave., New York City, Engrs.

Pa., New Castle—American Sheet & Tin Plate Co., Frick Bldg., Pittsburgh, will build additions and make alterations to steel plant, here. Estimated cost $200,000. Work will be done by separate contracts. G. C. Kimball, Frick Bldg., Pittsburgh, Company Engr.

Pa., New Castle—Johnson Bronze Co. is having plans prepared for the construction of 1 and 2 story, foundry and pattern shop, here. Estimated cost $75,000. H. K. Ferguson Co., St. Clair and East 106th Sts., Cleveland, O., Engr.

Pa., Philadelphia—American La France Fire Engine Co. will soon award contract for the construction of 1 story, 100 x 210 ft. sales and service building at 25th and Westmoreland Sts. Carson & Carson, 22 South 15th St., Engrs.

Pa., Philadelphia—J. Bodek, 216 Ledger Bldg., will soon award contract for the construction of 8 story, 67 x 125 ft. garage and service station, 819-23 Walnut St. M. A. Bernhardt, 721 Walnut St., Archt.

Pa., Philadelphia—Edward G. Budd Co., 25th St. and Hunting Park Ave., is having plans prepared for the construction of 5 story, plant for the manufacture of steel auto bodies, at Hunting Park Ave. and Stokley St., Ballinger Co., 12th and Chestnut St., Archt.

Pa., Philadelphia — Morris & Erskine, Archts., 1716 Cherry St., will receive bids until September 1, for the construction of 4 story addition to plant for the manufacture of electrical measuring instruments, at 4901 Stenton Ave., for Leeds & Northup.

Pa., Philadelphia—Otto Engine Works, 33rd and Walnut Sts., awarded contract for the construction of 1 story, 146 x 260 ft. plant at State Rd. and Rahn St. Estimated cost $70,000.

Pa., Pittsburgh — Alleghany County Comrs., Court House, awarded contract for the construction of 1 story, garage, on McKean St. Estimated cost $150,000. Noted July 29.

Pa., Rochester—Guarantee Liquid Measure Co. is having preliminary plans prepared for the construction of 1 and 2 story, 360 x 360 ft. manufacturing addition to plant, here. Estimated cost $500,000. Private plans.

O., Cleveland—G. L. Martin Co., 16800 St. Clair Ave., awarded contract for the construction of 1 story, 60 x 100 and 80 x 100 ft. factory additions, to airplane manufacturing plant, at 16800 St. Clair Ave. Estimated cost $60,000.

O., Cleveland—White Motor Co., 842 East 79th St., W. White, Pres., awarded contract for the construction of 1 story, 55 x 198 ft. factory addition at 842 East 79th St. Estimated cost $60,000.

Tex., Houston—Carnegie Steel Co., will soon receive bids for the construction of 7 buildings at plant, at Ship Canal and Southern Pacific R.R. tracks, here.

Ont., Ingersoll—Copelands Garage plans the construction of garage and repair shop, to replace fire loss. $60,000.